THE AMERICAN JOURNAL OF ROENTGENOLOGY, RADIUM THERAPY AND NUCLEAR MEDICINE

VOL. 69 JANUARY, 1953 NO. 1

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Issued monthly. Annual Subscription: United States, U. S. Possessions, Pan-American Union and Spain, $15.00; Canada and Newfoundland, $16.00; other foreign countries, $17.00. Current single numbers, $1.50. Distributed in the British Commonwealth of Nations by Blackwell Scientific Publications, Ltd., 24–25 Broad Street, Oxford, England. Yearly price £6.5.0.

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Entered as second-class matter February 10, 1930, at the postoffice at Springfield, Illinois, and Menasha, Wisconsin, under the Act of March 3, 1879. Accepted for mailing at the special rate of postage provided for in the Act of February 28, 1925, embodied in Paragraph 4, section 538, P.L. and R. authorized February 10, 1930. Delivery is not guaranteed. Replacements are not guaranteed nor promised, but will be attempted if extra single copies are available and only if requested within 30 days from first of month following publication (17th of month) for domestic subscribers and 60 days for foreign subscribers. A 30 day notice of a change of address is requested. When ordering a change of address, send the Publisher both the old and new address.

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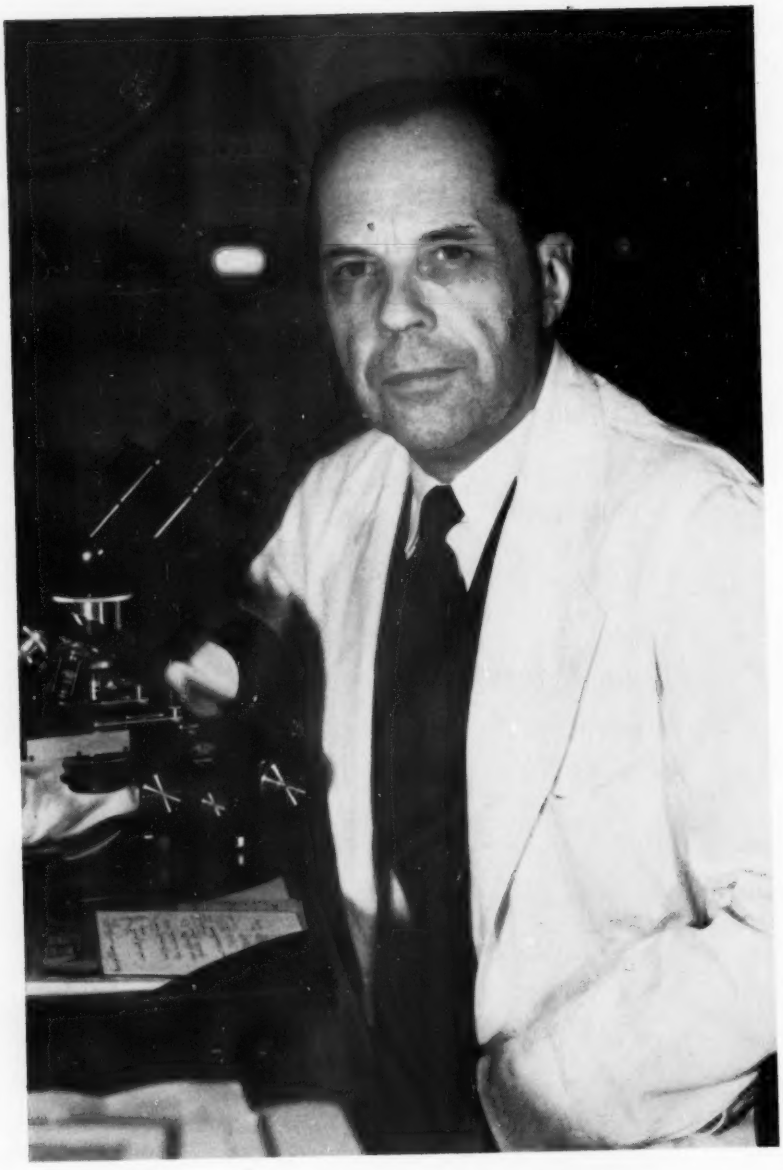

ARTHUR PURDY STOUT

Janeway Lecturer, 1952

THE AMERICAN JOURNAL OF ROENTGENOLOGY
RADIUM THERAPY AND NUCLEAR MEDICINE

VOL. 69 JANUARY, 1953 NO. 1

INTRAMUCOSAL EPITHELIOMA OF THE LARYNX

JANEWAY LECTURE, 1952*

By ARTHUR PURDY STOUT, M.D.
NEW YORK, NEW YORK

NOT only do I feel honored that you have selected me to give the Janeway Lecture this year but it affords me a peculiar satisfaction for I knew Harry Janeway slightly and have a vivid recollection of him. It was in 1909 when I was a student at the College of Physicians and Surgeons of Columbia University. In addition to his connection with the organizations formerly called the General Memorial Hospital and the New York Skin and Cancer Hospital, he also worked in the Vanderbilt Clinic for a brief period in those early days of the first decade of this century. At that time the Vanderbilt Clinic was an independent out-patient institution connected only with the Medical School. It was not until 1928 that it became the outpatient clinic of the Presbyterian Hospital. I have a mental picture of a tall slender man with a keen expression busily removing skin tumors. His face was lopsided because one mandible had been removed for adamantinoma but one forgot this in conversation because of his interests and enthusiasms. That adamantinoma was to prove fatal. Twenty-five years after the jaw resection it reappeared in the temporal bone and eventually led to his death. The diagnosis had been confirmed by William H. Welch and both my former chief, William C. Clarke, and I saw sections of it.

There is another bond with the subject of this lecture and Harry Janeway. The fifth Janeway Lecture was delivered in 1937 by Douglas Quick on the subject of carcinoma of the larynx, with a certain phase of which subject this present lecture will deal. Dr. Quick was Dr. Janeway's original and only assistant during his period of activity at the Memorial Hospital. He is a member of your Society's committee which selected me to give this present lecture although he did not know in advance what would be its subject. Incidentally, I am happy to report that the new unit recently opened at the Roosevelt Hospital, New York, is called the Henry Harrington Janeway Clinic for Therapeutic Radiology. I am sure that Dr. Quick who is in charge of this unit

* The seventeenth Janeway Lecture, delivered at the Thirty-fourth Annual Meeting of the American Radium Society, Chicago, Illinois, June 8–10, 1952.

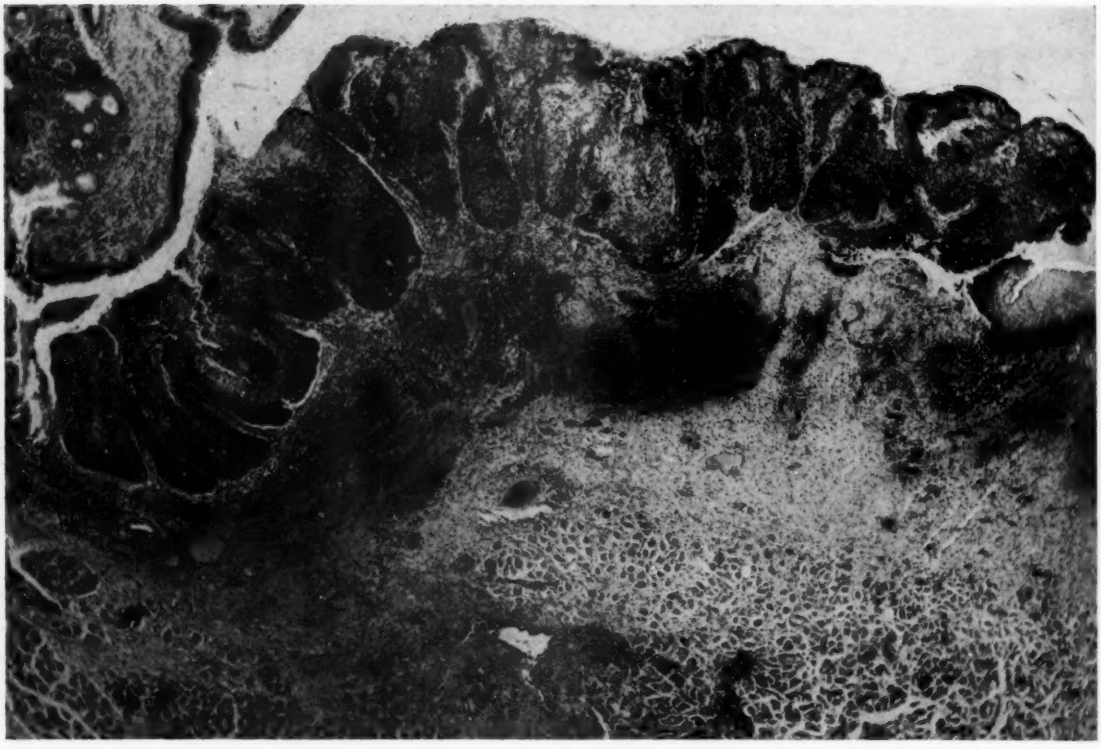

FIG. 1. *Intraepithelial epithelioma of the vocal cord.* Male, aged fifty-seven. Hoarseness for seven months. A small mass was observed just below the anterior commissure. After biopsy diagnosis of squamous cell epithelioma a total laryngectomy was done. The photomicrograph shows the lesion near the anterior commissure in the right cord. Glandular epithelium at the left and squamous epithelium at the right. A second independent intraepithelial epithelioma was present in the posterior part of the right cord. No recurrence after seven and a half years.

must have bestowed upon it the name of the man for whom this series of lectures is named.

We remember Harry Janeway because he was more than just a cancer therapist, he was a philosopher seeking underlying causes. I possess a reprint of an article by him which appeared in the 1910 issue of *Zeitschrift für Krebsforschung* to which I will refer briefly for it will serve to introduce the particular topic of today's remarks. It is entitled "A Contribution to the Knowledge of the Early Stages of Epithelioma of the Skin." In it Dr. Janeway discusses the features of early cancerous changes in the epidermis and there are excellent illustrations of microscopic basal and squamous cell tumors, particularly those of the multicentric or so-called pagetoid type. He speculates about the relationship of chronic inflammations and cell segregation to the formation of the multiple small cancers, about changes in the papillary connective tissue and capillary congestion. Most of these are phenomena about which we still speculate. He noted, however, that in some skin cancers there occurs a metaplastic change which seems to arise without any observed associated factors as if it was something that happened to individual epidermal cells alone and was in the nature of a metaplasia. This article appeared two years before Bowen published his study of what he called a precancerous dermatosis and which today we recognize as a form of intraepidermal cancer.

I hope you will pardon me if next I relate the steps which eventually led me to interest myself in the intramucosal cancers

of the larynx. I venture to do so because it will illustrate how important it may be for a knowledge of cancer to have, in addition to specialists dealing exclusively with localized parts of the body, individuals such as radiologists and pathologists whose field is the whole body.

After Bowen described his lesion in the skin in 1912, it became well known to dermatologists and gradually to others interested in cancer of the skin. There was a good deal of discussion as to whether or not it should be regarded as true cancer or only a metaplastic phenomenon of a precancerous nature.

In 1932 we observed a patient in our cancer clinic with a Bowenoid lesion involving the mucosa of the floor of the mouth. This was red, velvety and barely palpable. After biopsy it was treated with five interstitial radium needles totalling 500 milligram hours and disappeared, but five months later reappeared posterior to the original site. This area was excised and

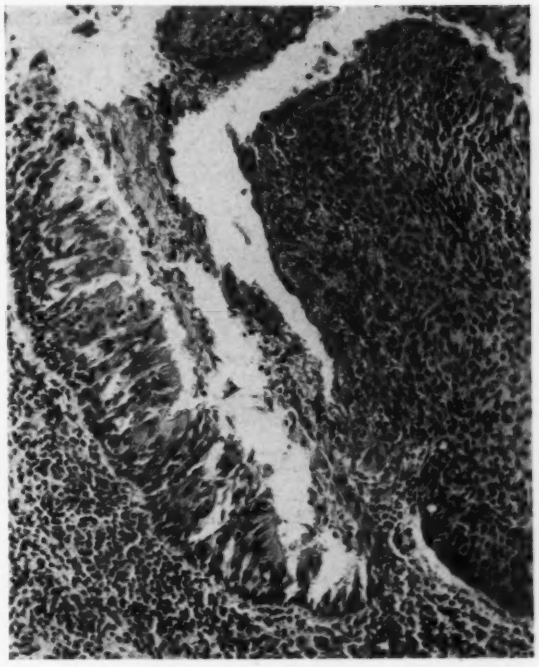

Fig. 2. Higher magnification of the case illustrated in Figure 1. The abrupt junction of the superficial epithelioma with the glandular mucosa is shown.

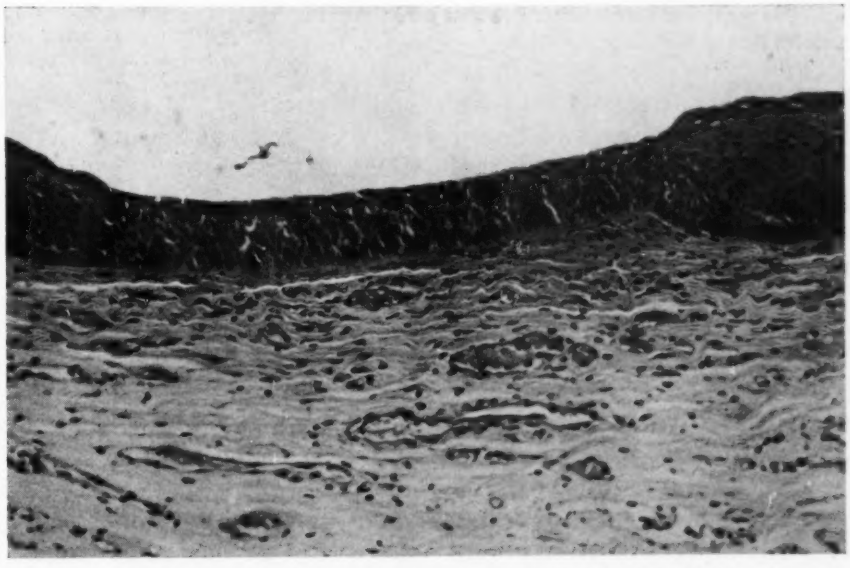

Fig. 3. A localized patch of intraepithelial epithelioma in a patient with extensive involvement of the right cord, the anterior commissure, the right ventricular band and the subglottic space. Total laryngectomy with no recurrence after fifty-three months. The original biopsy showed questionable invasion. This photomicrograph shows a small patch where the full thickness of the surface epithelium is replaced by anaplastic cells while at either end only the basal portion of the squamous epithelium showed proliferation of the anaplastic cells.

there was no further local reappearance, but two and one-half years later metastases appeared in the cervical nodes, which were excised and the area heavily treated by roentgen therapy. He lived nearly five more years and finally died eight years and four months after the original radium treatment of bronchopneumonia and cirrhosis, without further evidence of cancer spread. The recurrence in the mouth was serially sectioned and there was no evidence of tumor except in the surface mucosa which was entirely replaced by cancer cells.

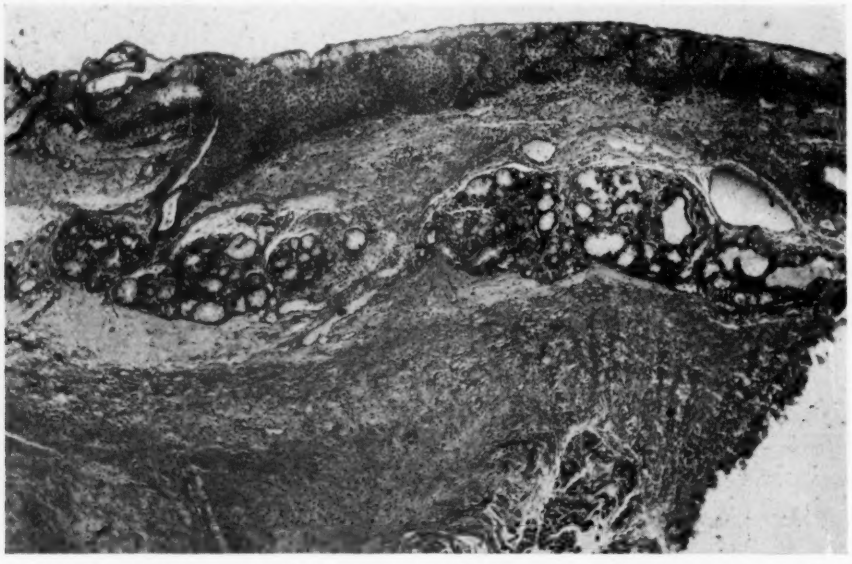

FIG. 4. Intraepithelial epithelioma of the right vocal cord. Male, aged sixty-one. Hoarseness for several weeks. The lesion was situated at the junction between the anterior and middle thirds of the right vocal cord. Laryngofissure. No recurrence after five years and seven months. The lesion thickens the surface mucosa and extends down one of the ducts.

This case made a profound impression upon me for it convinced me that an apparently superficial intramucosal cancer could metastasize, at least if it arose in the oral cavity. It also served to focus my attention on intraepidermal and especially on intramucosal cancer because it became apparent from the reports of other clinics and from our own rather meager experience that in situ cancer might turn into infiltrative cancer and produce metastases. In 1939 I published a paper on the subject and interested some of my associates in other departments to assemble the experience of cases available to them on intramucosal cancer. As a result, the late Richard Knight published one of the earlier studies on intramucosal cancer of the cervix uteri in 1943; John McGavic's paper in 1942 was the first to record the fact that this same process can affect the surface mucosa of the conjunctiva and cornea, and in the same year Brighton and Altmann described 3 cases involving the larynx as well as others in our collection in the pharynx and the oral and nasal mucosae. Since that time we have become aware that a comparable process can involve any mucous membrane with a surface covered by squamous or transitional cell epithelium. A superficial carcinoma can also affect mucous membranes lined by glandular mucus secreting cells such as are found in the gastrointestinal tract, for example. I studied the variety which involves the stomach called superficial spreading carcinoma and reported on it in 1942. But there is a vital difference between such superficial carcinomas in the gastrointestinal tract and those which arise

in the skin or the squamous and transitional cell mucosae. For whereas the latter are confined to the surface cells and the glands or crypts beneath them and do not infiltrate the substantia propria of the mucosa, the gastrointestinal superficial carcinomas involve the substantia propria from their very onset and thus are in contact with lymphatics and capillaries. Metastases therefore can and do occur in some 50 per cent of them by the time operation leads to their discovery.

Cancer in situ in the cervix, vagina, vulva and penis has had so much attention that it has become well known. Particularly its occurrence in the cervix uteri has become a major problem of treatment,

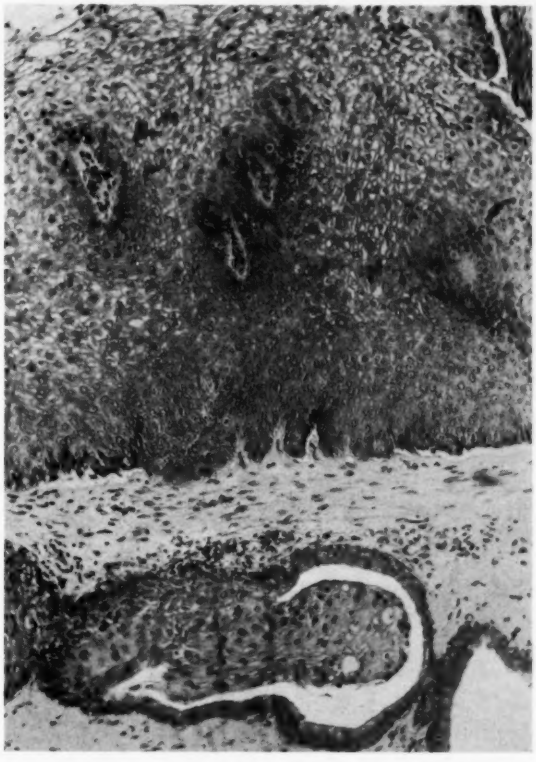

Fig. 5. Intraepithelial epithelioma in a case of leukoplakia. Female, aged fifty-three, with hoarseness for six months. Over a period of three years tissue was removed from the left cord five times and the right cord once. All of the biopsies showed leukoplakic thickening with intraepithelial epithelioma. Roentgen therapy, 3,200 r measured in air, was given to each of two fields. No recurrence after one year. The photomicrograph shows extension of the lesion into a gland.

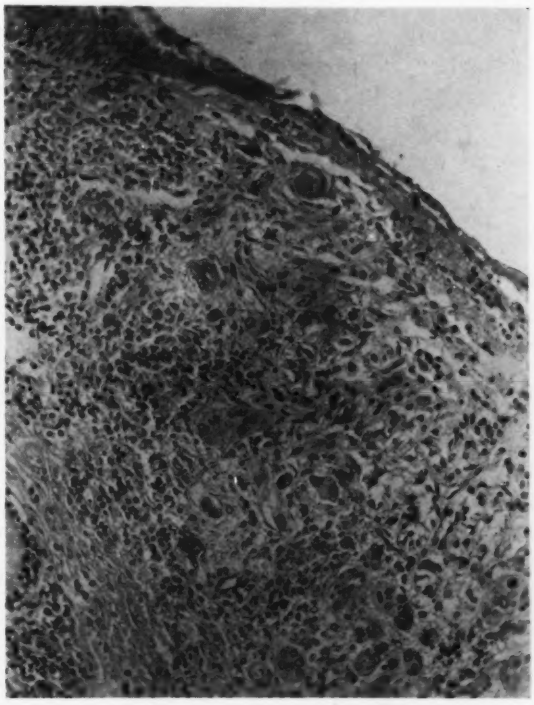

Fig. 6. Extensive intraepithelial epithelioma of the cord with area of microscopic invasion. Male, aged forty-seven. Intermittent hoarseness for seven months. Diffuse thickening of the entire right cord and a small patch on the left cord. Laryngectomy. No recurrence after seven years and four months. Both cords showed very extensive intraepithelial epithelioma. One small patch of microscopic invasion in the anterior part of the right cord. The photomicrograph showed the limited microscopic invasion.

for even today it is unknown how frequently this particular in situ cancer will become invasive and what should be done about it in young women. But cancer in situ in the larynx has received practically no attention. It was described by Benjamins in 1928 and again in 1933 and was referred to by Broders in 1932. It is briefly described in the 1942 edition of Jackson and Jackson's textbook on the larynx; solitary cases each associated with infiltrating cancer were described independently by Snitman in 1945 and by Brunner in 1950. But no one, so far as I am aware, has tried to find out more about it.

I became concerned about this for we were finding the lesion with sufficient frequency in our otolaryngological service to

FIG. 7. Extensive intraepithelial epithelioma with deeply infiltrating epithelioma of the right ventricular band. Male, aged seventy, with intermittent hoarseness for one year. Total laryngectomy. Palpable mass on right side of neck three years and three months later. Palliative radiotherapy and death shortly thereafter. Intraepithelial involvement found in left cord, anterior commissure and left aryepiglottic fold. The invasion had occurred in the right ventricular band. The photomicrograph shows extension from the surface into the ducts and glands.

make its proper treatment a matter of importance. The treatments used varied from biopsy alone through all the variations of surgery and radiotherapy to complete laryngectomy, and nobody knew what was proper and best. After repeated efforts I succeeded in enlisting the aid of two otolaryngologists, Dr. Franz Altmann and Dr. Irving Ginsberg. The cases were collected and analyzed by the three of us, and submitted for publication in the *Archives of Otolaryngology*. The information I shall present to you has resulted from our joint efforts.

Before submitting this information, I should like to emphasize one thing which is of prime importance philosophically as applied to tumors. The biological behavior of tumors of a comparable histopathological aspect as they develop in different regions of the body may be very different indeed so that it is never safe to make any assumptions about them based on analogy. The familiar example of this is the difference in malignancy between intraepidermal epithelioma of the skin which rarely exhibits clinical malignancy by invasive growth and hardly ever by metastasis whereas in mucous membranes the relationship with invasive cancer is usually more frequent. But whereas, for example, intramucosal cancer in the conjunctiva and cornea probably rarely becomes invasive and in this respect resembles the same type of lesion in the skin, in the oral cavity, pharynx and larynx the association is much closer and the process carries a greater threat to life.

From January, 1940, through June, 1950, there were 312 laryngeal epitheliomas diagnosed by histopathological examination on the otolaryngeal service of the Presbyterian

FIG. 8. Same case as Figure 6. Involvement of a terminal duct and gland acini without invasion.

Hospital. No less than 57 of these showed intramucosal changes which seemed to warrant the diagnosis of epithelioma. Nine cases occurred in recurrent papillomas. These have been omitted from consideration because papillomas seem to pose a special problem and the histopathological changes are such as to leave in doubt the propriety of considering them real evidence of malignancy. The remaining 48 cases showed definite intraepithelial cancer, forming 12.2 per cent of the total number. Nineteen of the 48 showed invasive growth in addition to the intramucosal epithelioma. In 9 this was of microscopic degree but in the other 10 it was extensive. The remaining 29 cases, or 9.3 per cent of the total number of laryngeal cancers, showed only intraepithelial epithelioma limited to the surface mucosa alone or extending into its glands.

The distribution among the sexes is the same as for invasive laryngeal epithelioma. Among 274 cases with invasive tumor there were 253 males and 21 females, a ratio of 12.1 to 1. Of the 29 patients with intramucosal epithelioma alone, there were 27 males and 2 females, a ratio of 13.5 to 1. However, unlike carcinoma in situ in the cervix where the mean age of women with that lesion is about ten years younger than for infiltrative cancer, in the larynx the mean ages are approximately the same: 57.2 years for infiltrating epithelioma, 55.8 years for patients with limited invasion and 58.4 years for cases of purely intraepithelial tumors.

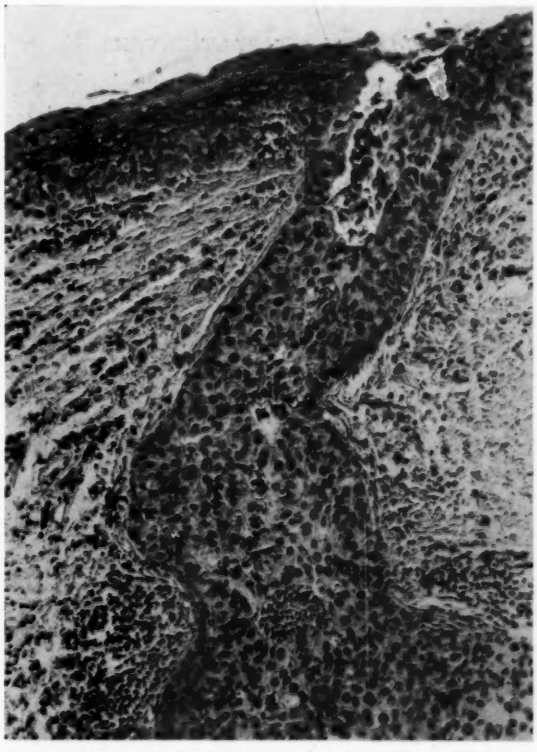

Fig. 9. Same case as Figures 6 and 7. Involvement of basal layer of surface epithelium and extension down a duct.

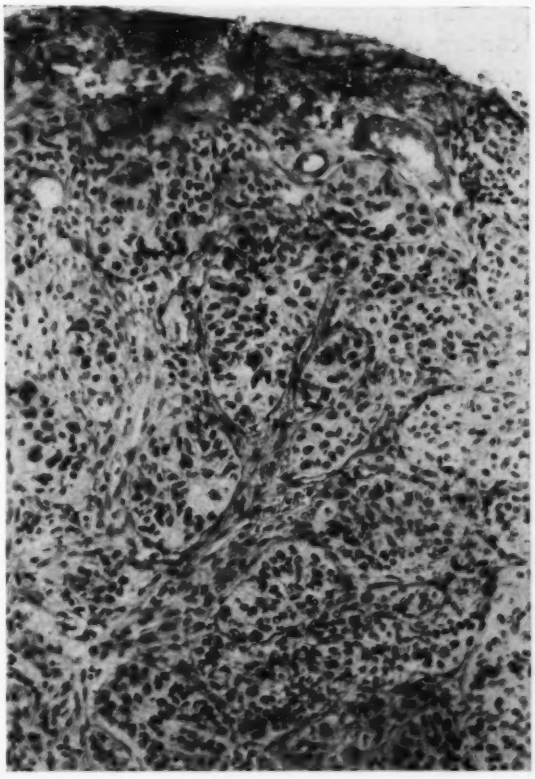

Fig. 10. Same case as Figures 6, 7 and 8. The invasive epithelioma of the transitional cell type is shown in the ventricular band.

HISTOPATHOLOGICAL CHARACTERISTICS

Intramucosal cancer of the larynx can affect any part of the larynx, whether intrinsic or extrinsic, although it is most commonly found on the vocal cords. It is always an epithelioma sometimes partly differentiated and epidermoid in character,

sometimes more nearly resembling the cancers of transitional cell epithelium. It is not possible to state at present whether or not it always starts in a bed of squamous epithelium; it is possible that when it first appears in areas normally covered by transitional epithelium this may undergo a preceding squamous metaplasia.

Be that as it may, the process develops as an alteration of the surface cells so that they appear anaplastic with the attributes of cancer cells. This commences in the basal layer, gradually reaches the surface and spreads out over the surface. By definition it must be contained by the basement membrane but it may extend down into the mucous ducts and glands and frequently does so but always with the proviso that it remains confined by the basement membrane limiting these structures. Just exactly how this process spreads remains uncertain because histological appearances can be deceptive. One is tempted to say that growth is often by spread within the mucosa because of the abrupt margins that often mark the junctions between cancerous and normal mucous membranes but I do not feel confident this is the case. It does seem probable that there can be multiple foci of origin (Fig. 3) because one can find small islands of cancerization in otherwise normal surface mucosae and apparently localized foci in glands and ducts, but without confirmation by serial sectioning, which I do not have, it is unsafe to state this as a fact. It is certain that the extent of mucosal involvement in the larynx can be microscopic and can also involve almost the entire laryngeal mucosa both intrinsic and extrinsic with all variations between these two extremes.

One of the features of intramucosal cancer is the fact that there is a very great difference in the degree of anaplasia; sometimes the cells are extremely bizarre, giant forms are found and differentiation seems completely lost; in other cases the change is not nearly so striking and one might hesitate to call the change cancerous. If one could state categorically that such changes are never associated with invasive cancer, it would affect the attitude toward treatment. Unfortunately, this less conspicuous form of intramucosal proliferation has been found adjacent to areas of infiltrative growth in a few instances so that it seems necessary to believe it carries the same possibility of conversion into infiltrative carcinoma as is the case with more histopathologically spectacular growths.

As in the cervix and other mucosae covered by squamous and transitional cell epithelium, one may encounter basal anaplasia limited to the deeper part of the mucous membrane and not extending to the surface. In the cervix this limited process is regarded with a good deal of equanimity; it is not called cancer and no treatment is deemed necessary. The same nonchalance would be unjustifiable in the larynx for all too frequently such a change is a harbinger of full fledged intramucosal and/or invasive cancer somewhere else in the same larynx.

CLINICAL CHARACTERISTICS

Since I am not an otolaryngologist and have not myself inspected these lesions, I shall depend upon the description of my colleague, Franz Altmann, with whom in association with Irving Ginsberg and myself these cases will be reported in the *Archives of Otolaryngology*.

The great majority of the tumors originated from the vocal cords. On laryngoscopic examination the noninvasive tumors appear as circumscribed or more diffuse grayish, whitish or more reddish thickenings of the vocal cord, with a smooth or slightly granular surface. The anterior part is usually involved, occasionally the lesion is found in the middle third. In some instances a more diffuse thickening of the entire cord or an extension into the subglottic space was observed but the motility of the cord was unimpaired in all instances. Sometimes the tumors originated near the anterior commissure and in that case not infrequently extended across the commissure into the other cord or downward into the subglottic space.

In 27 of the 29 noninvasive cancers the lesion had an intrinsic and in 2 an extrinsic loca-

tion. In 14 of the 27 cases the accuracy of the clinical findings could be checked through histopathological examination of the operative specimen; in 2 other cases the tumors were, as subsequent clinical observation showed, completely removed by biopsy.

It seems noteworthy that among the 16 cases checked by histopathological examination of the operative specimen, only 1 showed evidence of infiltrative growth. Less reliable was the clinical estimate of the extent of the lesion. In 7 of the 16 cases, the lesion extended over a larger area than had been suspected on clinical examination. It either spread over a larger part of one cord or even crossed over the anterior commissure into the other cord or extended downward into the subglottic region. Glandular metastases were never found, either on clinical or histopathological examination.

Of the 2 extrinsic cases, the lesion was found clinically in one over the tip of the arytenoid without apparent involvement of the interior of the larynx. In the second case it involved clinically the entire cord and the arytenoid but histopathological examination showed also involvement of the ventricle, the ventricular band and subglottic space. In this case evidently a primary intrinsic lesion had become extrinsic. (Table 1).

The 9 cases with limited invasion in the biopsies showed the following locations (Table II). The lesions in these cases were, as a rule, more extensive than in those without invasion. Again in only 1 case was extensive infiltrative growth found in the operative specimen after laryngectomy. In 4 others the lesion was found to be more extensive than on clinical examination. The limited invasion was always confined to the site of the biopsy and its neighborhood but intraepithelial changes extended throughout the cord, across the commissure into the other cord or diffusely into the cords, the ventricles, the ventricular bands or throughout the entire larynx.

The location of the lesions in the 10 cases with extensive invasive changes but with marginal epithelial spread is shown in Table III. In 4 instances the lesion was purely intrinsic, in 4 others the lesions had evidently been primarily intrinsic but had, by subsequent spread, secondarily become extrinsic and in 2 the location was primarily extrinsic. In all these cases the lesions were, as was to be expected, more extensive than in the preceding group, and in 5 of the 10 cases there were clinically recognizable metastatic cervical nodes. In 3 of the 5 larynxes available for histological study the microscopic lesions were more extensive than had been suspected clinically. This was due in one of them to extensive invasive growth, in one to

TABLE I

LOCATION OF 27 CASES OF INTRINSIC INTRAEPITHELIAL EPITHELIOMA OF THE LARYNX WITHOUT INVASION

Clinical Examination	Checked by Operation*	Confirmed	Not Confirmed
Ant. third of cord: 12	8	6	1—ant. third+subgl. sp. 1—entire cord
Ant. third+subgl. space: 1	1	1	
Middle third of cord: 7	5	2	1—middle+post. third 1—entire cord 1—both cords
Entire cord: 3	1		1—entire cord and subglottic space
Both cords: 4	1		1—both cords and subglottic space

* Those cases not checked by operation had biopsies alone or were treated by radiotherapy.
Two extrinsic cases are not included.
(Reproduced by permission from Altmann, F., Ginsberg, I., and Stout, A. P. Intraepithelial carcinoma (cancer in situ) of the larynx. *A.M.A. Arch. Otolaryngol.*, 1952, 56, 121–133.)

TABLE II

NINE CASES OF INTRAEPITHELIAL EPITHELIOMA OF THE LARYNX WITH LIMITED INVASION

Clinical Examination	Checked by Operation	Confirmed	Not Confirmed
Mid. third of cord: 1	1		1—ant. ⅔ and ant. commissure
Ant. ⅔ of cord: 2	2	2	
Entire cord: 3	3	1	1—ant. commissure and opp. cord 1—widespread involvement
Entire cord+ant. ⅓ opp. cord: 1	1	1	
Ant. com.+ant. parts both cords: 1	1		1—also ventricles and bands and post. cords
Ant. com.+subglot. sp.: 1	1		1—also all right cord and ant. part left cord

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TABLE III

TEN CASES OF INTRAEPITHELIAL EPITHELIOMA OF THE LARYNX WITH MARKED INVASION

Clinical Examination	Checked by Operation*	Confirmed	Not Confirmed
Cord and ventl band: 2	2	1	1. Also near aryepigl. fold and interaryt. reg.
Ant. com.+ant. ⅓ both cords: 1	1	1	
Ant. com.+both cords: 1	1		1. Also vent. aryepigl. fold and pyriform sinus
Cord+vent. band+epigl.: 1			
Cord+vent. band+aryep. fold: 1			
Cord+vent. band+aryep. fold and cart.: 1	1		1. Also ant. com. opp. cord and ary. fold
Cord+aryep. band and cart. +pyriform fos.: 1			
Aryt. cart.+interaryt. and post cricoid regs.: 1			
Pyriform fossa: 1			

* Cases not checked by operation had biopsy with or without radiotherapy.

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extensive superficial spread and in one to multicentric development of intraepithelial lesions throughout the larynx.

A comparison of the three groups shows that the noninvasive tumors were, as a rule, smaller than those with limited invasion and that those with marked invasion were the most extensive ones.

DIAGNOSIS

A study of the distribution of the cancerization of the larynx in this group of superficial cases must convince one that it will not suffice to rely on a single biopsy in cases of cancer in mobile mucosae for this will neither show the extent of the lesion if it is intramucosal nor whether or not there is evidence somewhere of limited or more extensive invasion. Reference to Tables I, II and III will show that among 30 cases of intramucosal cancer with and without invasion which were biopsied and later had either laryngofissures or laryngectomies, the extent of the lesion was greater than supposed in exactly one-half of that number. Whatever type of treatment is to be undertaken, it will be carried out with greater intelligence and efficiency if the extent of the process, the degree of involvement of the mucous glands and their ducts and the presence or absence of limited or deep invasion is determined by taking multiple biopsies not only of the suspicious areas but of other sites both intrinsic and extrinsic.

TREATMENT

Although I do not feel that the factual evidence available is sufficient to enable one to select the form of treatment which is best in every case, nevertheless there is enough to permit one to discuss treatment with some degree of assurance. The results of treatment of this group of cases are summarized in Tables IV and V. It should be pointed out that all cases were biopsied at least once and many repeatedly. In each instance the most radical and final form of treatment used is the only one mentioned although it was not necessarily the only one used. Thus some cases eventually treated by laryngectomy had preceding laryngofissures. First, let it be said that a total laryngectomy will probably cure every case of intraepithelial epithelioma both those which are noninvasive as well as the superficially invasive ones and, in addition, most of the cases associated with more extensively invasive intrinsic epithelioma. But total laryngectomy is a surgical procedure which leaves the patient severely handicapped so that if there is any way of avoiding it, this is greatly to be preferred.

While it was possible in 3 cases to remove the lesion by biopsy alone, this form of treatment hardly seems justifiable when it is realized how frequently a small area of involvement is associated with clinically unsuspected areas elsewhere, and even sometimes with invasive cancer this form of treatment probably should only be resorted to if the condition of the patient does not warrant any other.

Nor does laryngofissure with removal of a single cord seem the best treatment, even though it has frequently proved successful in this series, because of the difficulties in selecting the proper cases for this form of treatment and also because when it fails it means almost inevitably a laryngectomy.

The best form of treatment for intraepithelial epithelioma of the intrinsic larynx with or without superficial invasion theoretically is one which will remove or destroy all of the mucous membrane together with the mucous glands and their ducts. This latter is important to stress because of the frequency with which the intraepithelial proliferation descends into these structures and because they often extend deeply beneath the surface. I have heard it suggested that it might be possible to excise all of the mucosa and its glands leaving only the fibromuscular framework of the intrinsic larynx. Whether or not this is possible or feasible I do not know, but it would seem to me exceedingly difficult to be certain all of the ramifications of the glands had been removed because of the deep penetration of some of them.

TABLE IV

RESULTS OF TREATMENT

Twenty-nine Cases of Intraepithelial Epithelioma of Larynx Without Invasion

Intrinsic tumors	27	
Followed	25	*Biopsy only* 4—3 well (11, 70, 112 mo.). 1 died cause (?) before treatment. *Laryngofissure* 10—all well (10, 11, 26, 26, 30, 37, 50, 52, 54, 78 mo.). *Laryngectomy* 2—1 well (60 mo.). 1 died cerebral hemorrhage (31 mo.). *Radiotherapy* 9—5 well (12, 15, 25, 30, 68 mo.). 4 died—3 of cardiac failure (15, 22, 36 mo.): 1 with perichondritis (56 mo.).
Extrinsic tumors	2	
Followed	2	Laryngofissure 1—incomplete removal died carcinoma (21 mo.). Radiotherapy 1—died cardiac failure (15 mo.)

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It would seem to me that destruction of the mucosa of the larynx can be obtained more effectively by roentgen therapy and that this should be a better form of treatment. In this present series it has not had a fair trial because the cases dealt with by radiotherapy were usually those considered poor operative risks and it is not surprising to find that 3 of the 9 patients with superficial intrinsic cancer without invasion treated by roentgen therapy died of heart disease from one to three years after treatment. It is true that one patient died as a result of improper dosage, causing necrosis of cartilage and infection, but this does not occur when proper dosages are used. No conclusion can be drawn from the patient with superficial extrinsic epithelioma without invasion who died of heart disease fifteen months after radiotherapy because he would have died of this anyway no matter what treatment was used. The extrinsic cases with deep invasion treated by radiotherapy were problems primarily of extensive invasive cancer of the extrinsic larynx and not of the associated intraepithelial spread so that they are not proper for discussion at this time.

The achievements of radiotherapy in the treatment of simple primary intrinsic cord tumors are well known. Since they are so successful I can think of no reason why a similar success should not attend

TABLE V

RESULTS OF TREATMENT

Nineteen Cases of Intraepithelial Epithelioma of Larynx With Invasion

		Cases with Limited Invasion
9 cases all intrinsic and all followed		Laryngofissure 4: all well (45, 56, 65, 115 mo.) Laryngectomy 5: all well (26, 51, 76, 82, 103 mo.)
		Cases with More Extensive Invasion
10 cases—		
Intrinsic tumors	4	
Followed	3	Laryngectomy 3: all well (19, 27, 46 mo.)
Extrinsic tumors	6	
Followed	5	Laryngectomy 1: incomplete removal, died (39 mo.) Radiotherapy 4: all died (5, 14, 28, 30 mo.)

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treatment of intraepithelial epithelioma of the larynx, provided only that all of the laryngeal mucosa is included in the field treated.

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INTESTINAL OBSTRUCTION IN FIBROCYSTIC DISEASE OF THE PANCREAS

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IN THE last decade a considerable literature has accumulated on the subject of fibrocystic disease of the pancreas. The very frequent relationship of meconium ileus to fibrocystic disease of the pancreas has also been stressed, but the apparently frequent connection between meconium peritonitis and fibrocystic disease of the pancreas has not been emphasized adequately in the English literature. For instance, in two fairly recent reports on meconium peritonitis with roentgen evidence of abdominal calcification, mention was not specifically made of examination for evidence of fibrocystic disease of the pancreas.[28,31] Also, in a report on the roentgen changes associated with pancreatic deficiency in early life, no mention is made of meconium peritonitis, with or without calcification.[32] The practical importance of establishing a relationship between these three conditions, and of attempting early roentgenologic diagnosis, lies in the fact that the outlook following surgical treatment is no longer hopeless. As late as 1945, Swenson and Ladd stated that "whereas surgical progress has been made in conditions like esophageal atresia, omphalocele, diaphragmatic hernia, intestinal atresia, volvulus and imperforate anus, meconium ileus still kills all its victims." But since the report of Hiatt and Wilson, with 5 out of 8 patients surviving operation, the operative outlook has changed. To date, however, there still have been reported fewer than 10 cases in which surgical treatment has been successful.

DEFINITIONS

Meconium ileus is partial or total obstruction of the bowel in a newborn infant owing to inability to pass meconium, the inability being due to the extremely tenacious and sticky quality of the meconium. The reason for the abnormal consistency of the meconium is said to be the pancreatic achylia with which meconium ileus is almost invariably associated. Not infrequently, meconium ileus is complicated by volvulus which is thought to be secondary to the intense peristaltic efforts at propelling the putty-like meconium through the ileum.

Meconium peritonitis is sterile peritonitis that occurs during the last months of intrauterine life, during birth, or shortly after birth. It is the result of perforation of the bowel during any of these periods, with extrusion of the meconium into the peritoneal cavity. It may be a sequel of intestinal obstruction due to conditions such as intestinal atresia, malrotation and volvulus, intussusception, congenital sacculation of the bowel, and so forth. In a number of cases it results from meconium ileus secondary to cystic fibrosis of the pancreas. The site of perforation often cannot be discovered, either at operation or at necropsy, owing to complete healing of the site of rupture.

It is interesting that calcium deposition may occur in the extruded meconium, and Low and co-workers have cited evidence that such calcification may occur within twenty-four hours. Occasionally the deposition of calcium is sufficient to be visible on a roentgenogram. A review of the literature reveals that peritoneal calcification associated with peritonitis in the newborn probably occurs rather infrequently. From the roentgen point of view, it is interesting to note that the possible associa-

tion of such peritoneal calcification with fibrocystic disease of the pancreas has not been stressed. We have found reference to 11 cases of fetal peritonitis associated with calcification.[1,8,16,28,29,31,37] In only 5 of the 11 cases was calcification described roentgenologically.[8,28,31]

INCIDENCE

Meconium Peritonitis. Low and coworkers stated in 1949 that only a few more than 100 cases of this condition have been reported in the literature. It is impossible to state how frequent the association with cystic fibrosis of the pancreas is, because even for cases reported as recently as 1940,[20] 1944[31] and 1949,[28] no mention is made of an investigation as to the possible presence of cystic fibrosis of the pancreas. Landsteiner in 1905 and Sako in 1949 reported specifically on the pancreatic lesion associated with meconium peritonitis in their cases. Although a proved relationship between meconium peritonitis and cystic fibrosis of the pancreas has been mentioned only rarely, it would appear that, if looked for, such an association may be found much more frequently.

Meconium Ileus. Levy collected from the literature reports of 55 cases in which intestinal obstruction in infants was associated with proved fibrocystic disease of the pancreas. To these he added 1 case. These and the cases reported by Rogers and coworkers and by Sako make a total of 65 such cases. Most of these were cases of true meconium ileus. In about a dozen of the cases, there was an associated atresia of a portion of the small intestine.

PATHOGENESIS

Meconium. Meconium is a sterile mixture of cast-off epithelial cells, bile pigment, bile salts, cholesterol, fat, stearic acid, sebaceous material from swallowed liquor amnii, mucin and salts.[6] It is thought to act as a stimulus to peristalsis, thus aiding in the proper development of the intestinal tract. Peristalsis probably begins about the third month of fetal life. Keith is cited by Hurwitt and Arnheim to the effect that meconium normally reaches the ileocecal valve at the fourth month of fetal life, and is to be found in the rectum by the fifth month.

Pancreatic Secretion and Meconium. Farber[14] credited Landsteiner with being the first to correlate pancreatic fibrosis in the newborn with intestinal obstruction due to grossly abnormal meconium. Since Landsteiner's report in 1905, a pancreatic lesion of the type called "cystic fibrosis of the pancreas" has been described 65 times in infants suffering from meconium ileus, and a cause-effect relationship has been stipulated between the pancreatic achylia and the abnormality of the meconium causing the obstruction. In 1929, Kornblith and Otani stated that the absence of pancreatic juice probably resulted in failure of digestion of fats and proteins in the meconium, and also deprived the meconium of a diluting factor. Farber[14] found that the abnormal meconium in 4 cases of meconium ileus dissolved easily in 1 per cent, 5 per cent and 10 per cent solutions of a commercial pancreatic extract in saline solution, at 37.5° C. It was not stated, however, whether control experiments were done with saline solution only, or with bile extracts. In the latter connection, it should be mentioned that there have been reports of meconium ileus occurring in cases of congenital atresia of the bile ducts in which the pancreas was normal.[10] Although the pancreatic achylia-meconium ileus interpretation is probably a correct one, there are some contradictions and discrepancies in the observed facts:

1. It has been stated,[4] on the basis of serial-section studies of the pancreas in 5 cases of cystic fibrosis of that organ, that congenital atresia of the pancreatic ducts occurring as an embryologic malformation is the cause of fibrocystic disease of the pancreas. Sako's findings in 6 cases of meconium ileus would support this statement.

On the other hand, Farber's necropsy analysis[15] of 87 cases of cystic fibrosis of the pancreas revealed that in the majority of instances no evidence of congenital mal-

formation of the pancreatic ducts could be found. He stated that "if congenital obstruction of the (pancreatic) ducts were the cause of pancreatic fibrosis, meconium ileus should be a constant finding in all patients with this lesion, and such is not the case."

If the pancreatic achylia by itself is the cause of meconium ileus, Farber's statement would be correct. Farber does not, however, state whether serial-section studies were made in his cases. On the other hand, if the findings of Baggenstoss and co-workers are correct, it suggests that pancreatic achylia as such is not the cause of the inspissation of meconium in meconium ileus, and that the cause lies elsewhere. More serial-section studies of the pancreas in fibrocystic disease of the pancreas are indicated.

2. According to Boikan, the pancreatic external secretions are normally formed by about the fifth fetal month, and Windle states that trypsinogen and lipase have been traced as early as the fourth fetal month. On the other hand, Keith is cited as stating that meconium normally reaches the ileocecal valve at the fourth fetal month, and the rectum by the fifth fetal month. These figures would seem to imply that normally meconium has already reached the ileocecal valve, and possibly the rectum, by the time the formation of pancreatic external secretion begins. Is it possible to deduce that pancreatic external secretion does not have an influence on the consistency of meconium? One may mention here the case reported by Levy in which intestinal obstruction developed in a seven month old child suffering from cystic fibrosis of the pancreas. The child was receiving 60 grains (4 gm.) daily of pancreatin at the time obstruction developed, and had been taking similar amounts of the substance daily for four months. At necropsy the only cause that could be found for the intestinal obstruction was the putty-like consistency of the intestinal contents.

There appear to be two ways out of the quandary. On the one hand, it must be granted that the clinical relationship between pancreatic achylia and meconium ileus is too well established to quibble about it. It may be, then, that further proof is needed to confirm the statement that pancreatic external secretion begins about the fourth or fifth fetal month. It might be found to occur considerably earlier.

Secondly, it is probably correct to regard the abnormal meconium not only as the result of pancreatic achylia, but partly as a reflection of an abnormality of the secretion of the intestinal glands and other glandular structures such as the salivary and bronchial glands. In this connection, Farber's substitute term for cystic fibrosis of the pancreas, namely, mucoviscidosis, is far more accurate. Glanzmann and Berger found that the abnormal meconium in mucoviscidosis contains a protein which, in the presence of water, combines with fats and produces a very firm jelly. This protein is present in normal meconium either not at all or only in very small amounts. Matheson tentatively raised the possibility that the widespread secretion of sticky material by the glandular systems may be a result of an inadequate supply or distribution of hyaluronidase at these points. One may say then that although pancreatic achylia is present, it alone need by no means be the actual cause of the putty-like consistency of meconium in meconium ileus.

A few recent articles on fibrocystic disease of the pancreas may be mentioned as adding to the interesting problems posed by this disease. Glanzmann has described cases in which erythroblastosis fetalis coexisted with meconium ileus. In 3 of his cases the mothers' blood was Rh negative and that of the children Rh positive. It is postulated by the author that Rh antibodies penetrate by way of the liquor amnii into the canal systems of the lungs, intestines and pancreas, reacting there with antigens produced by the respective organ cells, thereby permanently damaging the glandular cells, the damage being manifested by abnormally tenacious secretions and all the consequences. Brunkow and co-workers reported a case of meconium

peritonitis in which the possibility of erythroblastosis fetalis was raised but not accepted. A previous sibling had died of erythroblastosis fetalis, and, while the mother's blood was Rh negative, that of the baby with meconium peritonitis was Rh positive.

Another interesting viewpoint concerns the possibility of a neurogenic abnormality. It is of note that in cases of meconium ileus that come to operation or necropsy the following features are shown with striking regularity: (1) there are hypertrophy and dilatation of the small intestine from the lower part of the jejunum to the midileum; this segment contains semifluid meconium; (2) the terminal 20 to 40 cm. of the ileum is thin-walled and contracted, and this region contains desiccated, tough, putty-like meconium; and (3) the large intestine is narrow, hypoplastic, and almost always empty. Bergstrand and Ehrenpreis have recently presented a case of meconium ileus in which the distal part of the ileum, the colon and the rectum did not have any myenteric ganglion cells. These segments were contracted in their case. It was thought that this manifestation possibly explained the meconium ileus on a similar basis as has been proved for cases of Hirschsprung's disease. These findings contrast with those in the case reported by Kornblith and Otani, in which they found the plexuses of Auerbach and Meissner to be normal in the dilated as well as in the collapsed segments of bowel.

Recently Ayers and co-workers reported on splanchnicectomies that were done in 24 cases of fibrocystic disease of the pancreas in the hope of breaking a hypothetical viscerovisceral pancreaticobronchial reflex in order to diminish bronchospasm and bronchorrhea. Three of the patients were thought to be materially benefited as far as the respiratory system was concerned.

Another observation that may possibly implicate a neurogenic factor in cases of fibrocystic disease is that children with the disease may be more susceptible to fainting from heat than are normal children.[23]

Farber[13] stated that pancreatic lesions similar to those in fibrocystic disease of the pancreas in children could be produced in kittens by the injection of parasympathetic-comimetic drugs such as pilocarpine. But Baggenstoss and co-workers cite the unsuccessful attempt by Ricks and co-workers to repeat Farber's results, using kittens, puppies and suckling pigs.

Although many of these findings are contradictory, it would seem that a general neurogenic cause, such as autonomic imbalance, has not been conclusively ruled out in fibrocystic disease.

Biliary Secretion and Meconium. Occasionally biliary achylia has been described as being associated, possibly in a causal relationship, with meconium ileus.[33] Thus Boikan cited Fanconi as presenting a case of meconium ileus in which the pancreas was normal but the biliary ducts were obstructed owing to aplasia. Fanconi's opinion, according to Boikan, was that lack of either bile or pancreatic juice may lead to inspissation of meconium. Landsteiner and also Von Meyenburg are cited as having had cases in which there were biliary and hepatic lesions.[10] On the other hand, Farber[14] studied 34 cases of congenital biliary obstruction in which the pancreas was normal, and in none was there evidence of meconium ileus. Andersen and Hodges have stated that local areas of hepatic cirrhosis, and hypoplasia of the gallbladder, are not uncommon in fibrocystic disease of the pancreas.

Intestinal Atresia and Meconium Ileus. A tentative statement may be made concerning the occasional incidence of atresia of a segment of the distal part of the small intestine in cases of meconium ileus. Levy has cited the work of Lelong and others who, he says, believe that the atresia may be a secondary effect of the meconium ileus and that it may not represent a primary failure of canalization of embryonic bowel. As support for the possible correctness of this interesting view, one may refer to the fact that in meconium ileus the abnormal meconium may be so firmly attached to the mucosa of the bowel that it appears to be an integral part of the bowel wall. Attempts to remove the meconium may result in actual tearing of the mucous

membrane, with bleeding. It is conceivable that the organization of such trauma by ordinary repair processes may result in either stenosis or even atresia of the bowels at such a site. It may be that such trauma occurs occasionally during violent peristaltic efforts of the bowel to drive on the tough meconium. A recent personal communication from Dr. Coleman, of Minneapolis, lends further support to this view. He found, in a case of fibrocystic disease of the pancreas with intestinal obstruction, that a segment of the small intestine was atretic, and chemical analysis of the contents of the intestine *beyond* the atresia showed the presence of bile.

TERMINOLOGY

In fibrocystic disease of the pancreas, intestinal obstruction may be due to atresia of the bowel, or only to impaction of meconium; it may also occur well after birth in the first year of life, when meconium is obviously not present; yet, the underlying fundamental pathology appears to be the same. It might perhaps be useful to have a term, such as "infantile pancreatic ileus," to cover all the types of obstruction and also to draw attention to the pancreatic lesion.

ROENTGEN FINDINGS

Meconium Ileus. There are no specific roentgen characteristics of this condition, but there are a few suggestive findings:

1. Overdistention of loops of small intestine, with air-fluid levels in the erect position, points toward the possibility of meconium ileus. Beyond the frank gas shadows, there may be a shadow of water density which contains many small and minute gas shadows. This appearance is thought to be due to gas being forced into the tenacious mucilaginous meconium. This sign was described by Neuhauser.[32] In 3 of the 8 patients operated on by Hiatt and Wilson, this sign was of value in determining a preoperative diagnosis. The sign is not specific, and we have seen it in imperforate anus, but it should definitely draw attention to the possibility of meconium ileus.

2. In a newborn child with evidence of intestinal obstruction, in whom the previously described sign is seen and in whom there is no evidence of imperforate anus, a very narrow, contracted colon should serve as a further indication of the possible presence of meconium ileus. The colon of a normal newborn baby is at least 1.5 to 2 cm. in diameter when studied by means of a barium enema. In meconium ileus, the colon will be about 0.5 to 1 cm. in diameter. Such a finding was, for instance, described in a thirty hour old infant with meconium ileus by Bronaugh and Lattimer in 1940.

3. Even in a newborn infant with fibrocystic disease of the pancreas, there may be evidence of emphysema of the lungs as suggested by a flattened and depressed diaphragm.

Meconium Peritonitis. There are three suggestive and two specific roentgen signs of meconium peritonitis. The three suggestive signs are the same as the three described for meconium ileus. The two specific signs are:

1. Free air in the peritoneal space in a newborn infant that has not yet passed meconium. This is definite evidence of rupture of the gastrointestinal tract. Such a finding was described in a four day old female infant in whom the main pancreatic duct was stenosed and in whom there were changes in the pancreatic parenchyma consistent with fibrocystic disease of the pancreas.[29]

2. Various degrees of calcification in the peritoneal space. Although calcification in the abdomen of an infant may possibly also occur in cases of congenital neuroblastoma, the calcification in meconium peritonitis can probably be differentiated by its relationship to intestinal shadows and its more anterior situation in the abdomen. Calcification visible on the roentgenogram in cases of fibrocystic disease with intestinal obstruction is the exception rather than the rule, but is a very valuable finding. It may also, of course, occur in meconium peri

tonitis which is not associated with fibrocystic disease of the pancreas.

TREATMENT

The treatment of meconium peritonitis associated with intestinal obstruction in cases of fibrocystic disease is essentially the same as the treatment of the intestinal obstruction. The principles of surgery in meconium ileus have been laid down by Hiatt and Wilson, and the outcome need no longer be fatal. Once an immediate surgical success has been achieved, a comprehensive medical program to maintain and build up the health of these patients is necessary.

PROGNOSIS

In infants having fibrocystic disease of the pancreas, the prognosis of meconium peritonitis is essentially identical to that of meconium ileus. In 1945, Swenson and Ladd stated that meconium ileus was still uniformly fatal. Hiatt and Wilson were the first authors to record significantly successful surgical outcomes in meconium ileus. Four of the 8 patients they operated on survived more than three and a half months, and 2 of the 4 patients were still alive at two years of age, at the time of their report. In 1949, Sako mentioned 2 patients who survived sixty-one and fifty-two days respectively after irrigation of the meconium-obstructed small intestine by means of ileostomy procedures. The patients died of respiratory infection and malnutrition.

It would appear that if the intestinal obstruction can be relieved by the newer surgical methods, the ultimate outlook will depend upon the severity of the lesions in the lungs, pancreas and other organs.

REPORT OF CASES

The following 2 cases of pathologically proved fibrocystic disease of the pancreas are reported because it is thought that the presence of calcification in the abdomen may have served to draw attention to the possibility of cystic fibrosis of the pancreas with complicating intestinal obstruction.

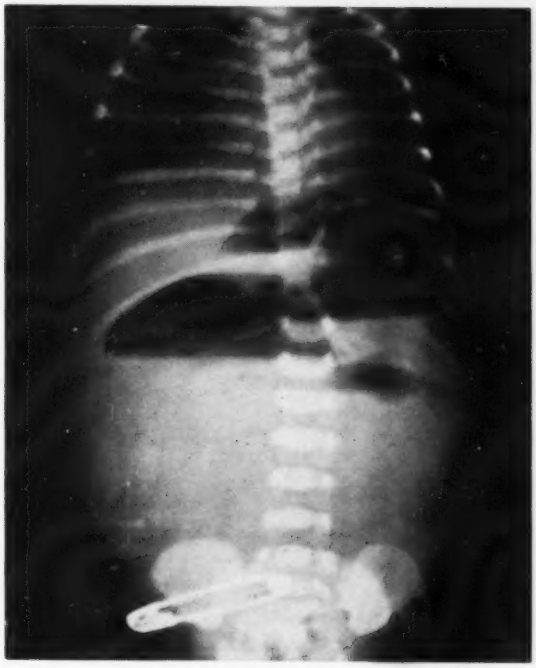

Fig. 1. Air-fluid levels of a pattern indicating obstruction of the small intestine. Calcification is evident in the right lower quadrant.

Case I. A female infant had vomited grass-green material five times on the first day of life, and had not passed any meconium. There was evidence of calcification in the right lower quadrant (Fig. 1). Operation revealed extensive and thick adhesions throughout the peritoneal cavity. The colon was $\frac{1}{8}$ inch (about 3 mm.) in diameter and the terminal part of the ileum was $\frac{1}{4}$ inch (about 6 mm.) in diameter. Proximal to the narrow segment of ileum was a region of atresia. Proximal to the atresia was a volvulus of the jejunum. After the intestines had been emptied as much as possible and the site of atresia had been resected, jejunoileostomy was done. The child died three days after operation. The available microscopic slides showed small flecks of calcium associated with portions of the resected ileum. A specific attempt had not been made at necropsy to find the calcium that was seen on the roentgenogram.

Case II. A boy was admitted to the hospital at the age of one month, with a story of vomiting and diarrhea which commenced twelve days after birth. On admission the abdomen was very distended and portions of the intestine that were distended with fecal material contained numerous tiny gas bubbles. A few small

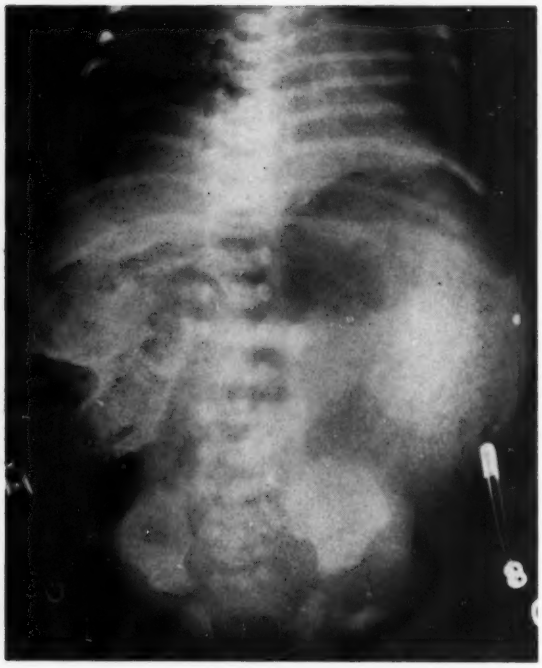

FIG. 2. Small flecks of calcification are present in the left side of the abdomen. There is a sausage-shaped "mass" of the density of water in the left flank, with numerous, small, interspersed gas bubbles.

areas of calcification were seen on the roentgenograms (Fig. 2). Vomiting continued, and exploration was undertaken. A volvulus of the midgut was found, and a congenital band obstructed the small intestine in two places, apparently causing inflammatory ulcers at the sites of constriction. The child died a few days after operation.

The presence of fibrocystic disease of the pancreas in this case raises the question whether a meconium peritonitis had occurred previously but without meconium ileus. At any rate, the presence of calcium as disclosed by the roentgenogram raised the possibility of the presence of fibrocystic disease, and if this child had survived operation, the roentgenogram would have aided in establishing the correct after-treatment for the systemic condition.

SUMMARY AND CONCLUSIONS

1. Calcification in the abdomen of a newborn child is, for practical purposes, indicative of a previous fetal peritonitis due to one of a number of causes.

2. It should be stressed that one of the causes of fetal peritonitis, with or without calcification, is intestinal obstruction complicating fibrocystic disease of the pancreas.

3. The importance of recognizing fibrocystic disease with complicating intestinal obstruction as a cause of peritonitis with calcification is that the outcome after surgical treatment of meconium ileus, with or without associated volvulus or atresia, is no longer uniformly fatal.

4. Some possible inconsistencies in the present concepts regarding the pathogenesis of meconium ileus are discussed.

5. There is strong evidence that atresia of the bowel in cases of fibrocystic disease of the pancreas is secondary to impaction of meconium, rather than a primary embryologic malformation.

6. Roentgenologic features of meconium ileus and meconium peritonitis are discussed.

7. Intestinal obstruction complicating fibrocystic disease of the pancreas (mucoviscidosis) may be due to meconium ileus; to impaction of meconium, with atresia or volvulus or both; or it may occur in infancy, well after the period when the term "meconium ileus" is applicable. It is suggested that a comprehensive term such as "infantile pancreatic ileus," would indicate intestinal obstruction associated with cystic fibrosis of the pancreas.

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ADDENDUM

In the September, 1952, issue of AMERICAN JOURNAL OF ROENTGENOLOGY, RADIUM THERAPY AND NUCLEAR MEDICINE, Kasmersky and Howard stress the fact that intra-abdominal calcification in infants with intestinal atresia may actually be in the lumen of the intestine in contradistinction to a peritoneal situation.

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ACCESSORY PANCREATIC TISSUE IN THE STOMACH WALL*

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ABERRANT pancreatic tissue in the wall of the stomach is an infrequent finding. By aberrant or accessory pancreas is meant an isolated mass of pancreatic tissue entirely separated from the main organ. According to Opie,[4] Klob in 1859 was the first to demonstrate the existence of isolated masses of pancreatic tissue. In this same text Opie reported finding ten accessory pancreatic glands in the gastrointestinal tract in a series of 1,800 autopsies performed in the Johns Hopkins Hospital. Kreig,[3] in a review of the literature and a report of 1 case, stated that up to 1939 approximately 340 cases of ectopic pancreatic tissue had been reported in the literature.

Considering what is known of the embryological development of the pancreas, it is somewhat surprising that the incidence of pancreatic inclusions in the gastrointestinal tract is not higher than reported. In explaining the origin of accessory pancreatic rests, Opie stated, "Should one or more embryonic buds of glandular tissue make their way into the wall of the intestine at an early period, they might be carried from the remainder of the gland by the longitudinal growth of the intestine; arising from the dorsal pancreatic outgrowth which is situated above the ventral, the aberrant tissue would be carried toward the stomach; if it arose from the ventral outgrowth, toward the jejunum. The existence of more than one accessory body above or below the pancreas is then explicable without assuming the occurrence of an embryonic condition unknown among the vertebrates."

Kreig, in the same article referred to above, stated that in a group of 300 cases reviewed by Poppe (1935) the distribution of the pancreatic inclusions was as follows: stomach 31.4 per cent, duodenum 31.83 per cent, jejunum 21.7 per cent, ileum 9.36 per cent, mesentery, etc. 3.37 per cent, biliary tract 1.49 per cent, and spleen 1.74 per cent.

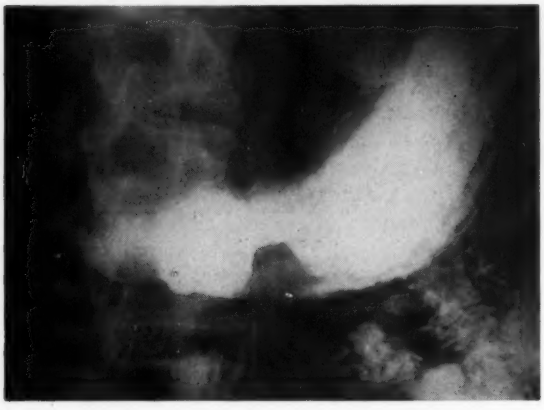

FIG. 1. Case 1. Large notch-like defect along greater curvature of stomach which was constant on serial roentgenograms.

FIG. 2. Case 1. Pressure spot roentgenogram outlines clearly the radiolucent defect. Mucosal folds over the defect are present and intact although slightly flattened and widened.

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Fig. 3. Case 1. (*A*) Resected specimen of stomach opened along greater curvature and with intramural tumor in situ. The tumor was the size of a walnut, discrete, firm, and not fixed to mucosa or serosa. The overlying mucosa was intact and in the upper portion of the specimen the mucosa covering the lesion is seen to be widened and flattened. (*B*) Another view of same specimen demonstrating size, outline, and lobulated surface of the tumor which was found to be a leiomyoma with pancreatic inclusion.

Bockus[1] stated that accessory pancreas has little clinical importance as it is usually an accidental operative or necropsy finding. Faust and Mudgett,[2] in a report of a case and a review of the literature, found that gastrointestinal disturbances were usually caused by the mechanical effects due to the growth of the ectopic pancreatic tissue. The presence of symptoms was dependent upon the site of the pancreatic inclusion. Palazzo and Schulz[5] reviewed the incidence of spindle cell tumors of the gastrointesti-

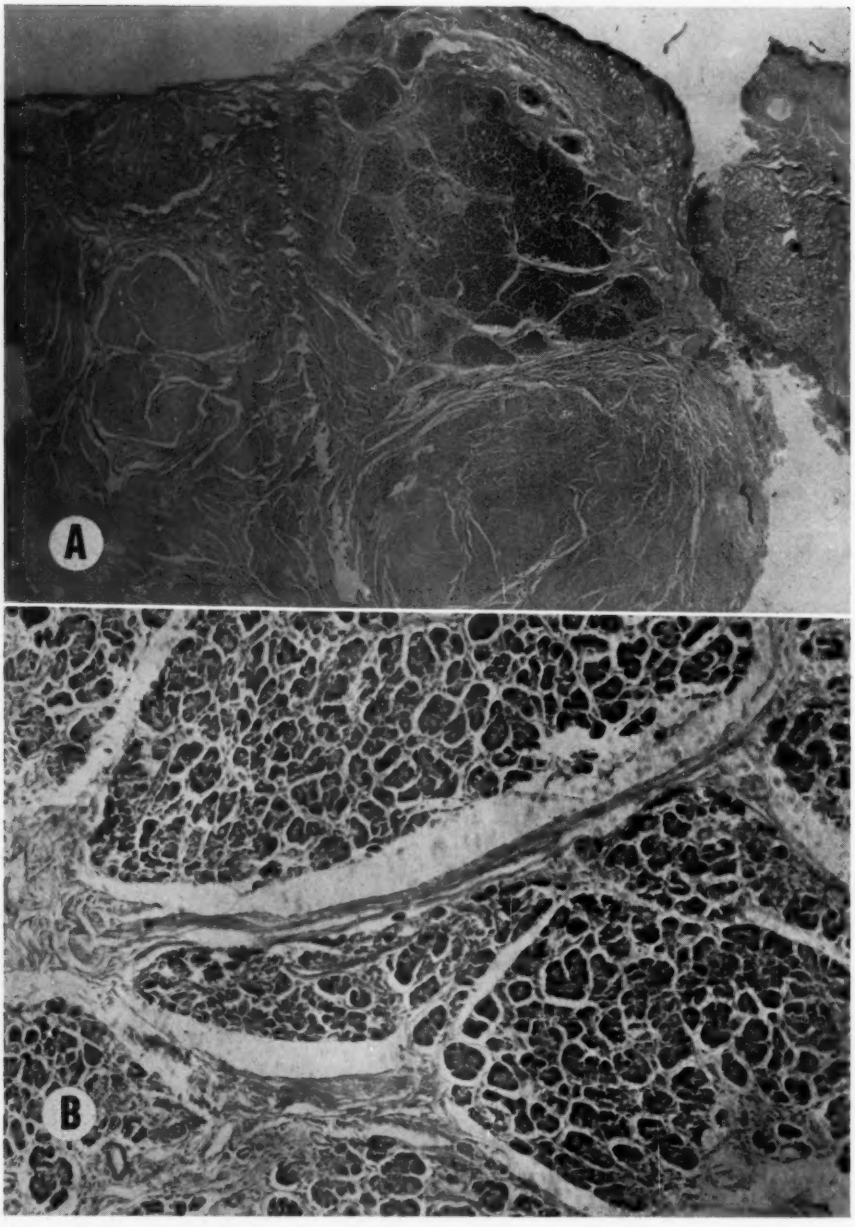

FIG. 4. Case 1. (*A*) Low power photomicrograph of tissue section through tumor illustrated in Figure 3. Most of the section is seen to be composed of spindle cell muscle bundles in a whorl-like arrangement. Throughout the muscle mass are scattered many discrete deep staining cellular islands which have a glandular pattern and in places have a lobular arrangement. Normal gastric mucosa is seen along the right border of this tissue section. (*B*) High power photomicrograph of same section reveals that the deep staining cellular islands in (*A*) are composed of normal appearing pancreatic tissue. The cells are pyramidal in type radially grouped about a small central lumen. Several large pancreatic ducts are present and an occasional island of Langerhans is seen.

nal tract in a combined study of 17,313 necropsy protocols and surgical pathological specimens. In this series 1 case of ectopic pancreatic tissue in the stomach wall was illustrated. There have been case reports of pancreatic inclusions in the

Fig. 5. Case II. Selected roentgenogram of stomach. Two sharply defined radiolucent filling defects are present in the pyloric portion of the stomach. These were interpreted as being a pedunculated polyp.

duodenum and remaining portions of the small intestine by other observers and an exhaustive review of the literature has not been attempted.

We recently examined 2 patients in each of whom a small extramucosal lesion of the stomach was found. In 1 patient the lesion was composed entirely of ectopic pancreatic tissue whereas the other was found to have a small leiomyoma in which there was a pancreatic inclusion. In both instances roentgenographic examination of the stomach revealed a constant filling defect. It was felt that this finding was rare enough to warrant the report of these additional cases.

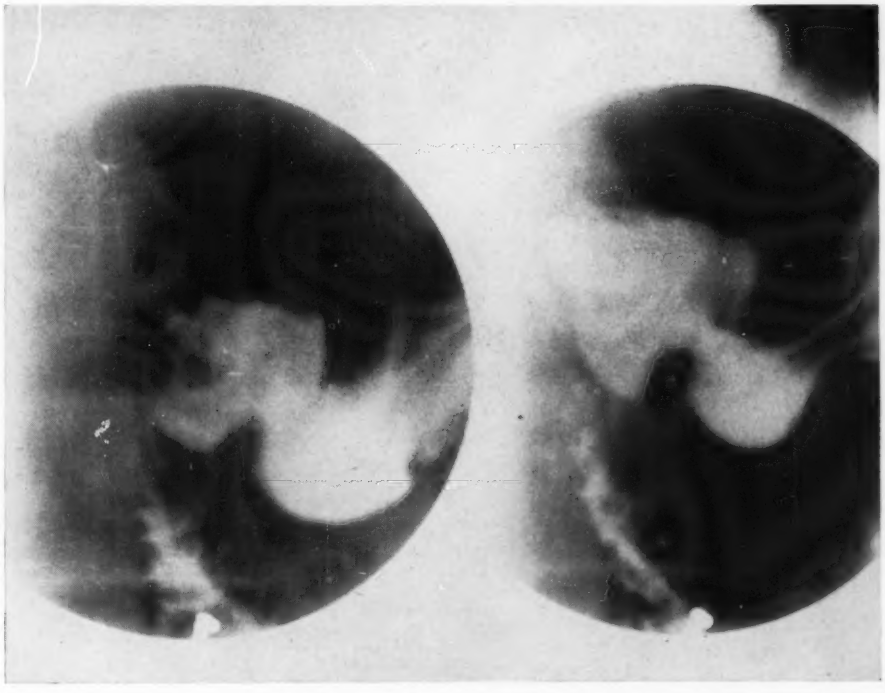

Fig. 6. Case II. Irregular translucencies in the duodenal bulb were demonstrated in this same case and were felt to be the result of intermittent intussusception of the suspected polyp. However, at operation the prepyloric mucosa was redundant and could easily be caused to prolapse into the duodenal cap, thus accounting for the roentgenographic appearance of the spot films of the duodenal cap.

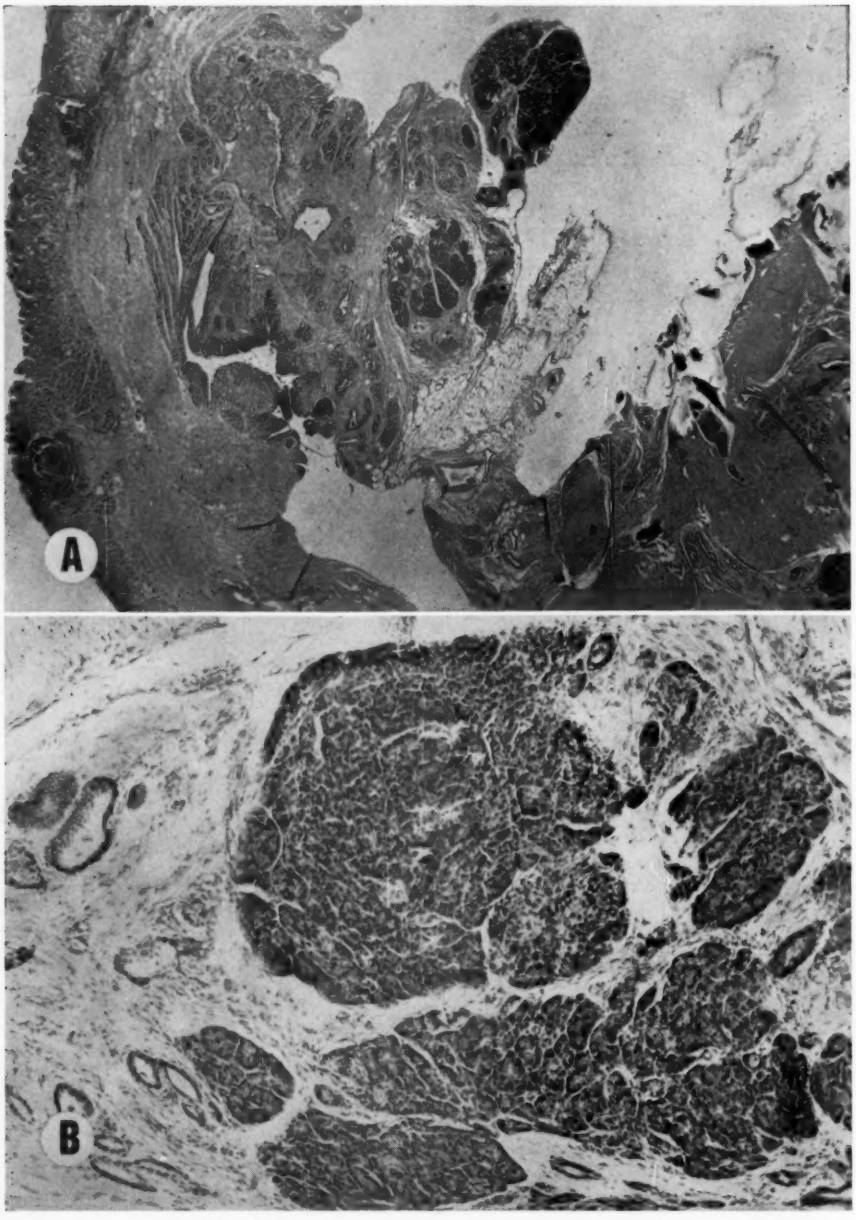

FIG. 7. Case II. (*A*) Low power photomicrograph through pyloric portion of stomach containing the small intramural tumor (see Fig. 5). The dark cluster of glandular tissue in the center of this section represents the pancreatic inclusion. (*B*) High power photomicrograph of same section reveals the glandular tissue to be normal appearing pancreas in the wall of the stomach. Numerous pancreatic ducts are also easily recognizable.

REPORT OF CASES

CASE I was that of a white dentist, aged fifty-four, a patient of Dr. C. V. Burt, who, following admission to St. Clare's Hospital for low back trauma, developed moderate painless abdominal distention for the first twenty-four hours. Despite the transient nature of the distention and the absence of symptoms, a gastrointestinal survey was ordered. Barium enema and small intestinal studies showed no abnormal findings. Examination of the stomach, however, revealed a notch-like filling de-

fect along the mid-portion of the greater curvature (Fig. 1). Spot roentgenograms with pressure (Fig. 2) showed the lesion to be a small walnut sized radiolucent defect over which the mucosa was intact but somewhat flattened. On the basis of the roentgenographic findings it was felt the lesion was extramucosal and probably represented a leiomyoma. The patient came to surgery as a result of the above findings and a subtotal gastric resection was performed. The resected specimen of stomach (Fig. 3, *A* and *B*) revealed a walnut sized tumor on the greater curvature over which the mucosa was intact and not ulcerated. The tumor on cross section was of a white color with a somewhat lobulated pattern throughout. Microscopic sections (Fig. 4, *A* and *B*) revealed typical pancreatic tissue in a leiomyomatous stroma.

Case II was that of a white broker, aged fifty-four, a patient of Dr. Russel Patterson, admitted to the New York Hospital with a history of two episodes of tarry stools within the preceding five years. At the time of the first episode of melena, he was admitted to a hospital and the diagnosis of a duodenal ulcer was made. The patient was asymptomatic until the present episode of passage of several tarry stools. There was no history of nausea, vomiting, hematemesis, constipation, diarrhea, or jaundice.

Laboratory data: Stool specimens for occult blood showed a 1+ guaiac on three separate examinations. Gastric analysis showed free HCl 70° (thirty minute specimen).

Barium enema study was negative. A gastrointestinal series (Fig. 5) revealed two translucent oval defects in the pyloric portion of the stomach having the appearance of a lobulated polyp. One spot roentgenogram of the duodenal bulb (Fig. 6) demonstrated an irregular transluency at the apex of the duodenal cap.

The roentgenographic interpretation was a pedunculated polyp of the pyloric portion of the stomach with recurrent intussusception into the duodenal cap.

Exploratory laparotomy was performed and a small firm tumor was located about 1 cm. from the pylorus on the mesenteric side of the stomach. There were also present hypertrophied mucosal folds which could easily be prolapsed through the pylorus accounting for the translucencies in the duodenal cap seen on the spot film of the duodenal cap (Fig. 6). A gastric resection was done and a study of the resected portion of the stomach, which included the pylorus and a small cuff of duodenum, revealed a small gray colored tumor 6 mm. in diameter in the greater curvature of the stomach and at the level of the pylorus. The mucosa over the lesion was intact and not ulcerated.

Microscopic sections (Fig. 7, *A* and *B*) revealed an irregular rounded mass of pancreatic acini immediately beneath the mucosa of the pyloric ring. There was no evidence of anaplasia or any other suggestion of malignancy. At the border of the acinar tissue were found closely packed collections of small pancreatic ducts.

The aberrant glandular tissue in both these cases did not differ in histological features from that of the normal pancreas.

SUMMARY

The case reports of two patients in whom roentgenographic filling defects in the stomach caused by intramural pancreatic inclusions are presented with appropriate illustrations. The defects produced in the two cases are dissimilar and do not exhibit any characteristics which would distinguish them roentgenographically from other types of extramucosal lesions. Case 1 is of particular interest in that the pancreatic inclusion existed in a small leiomyoma.

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BRONCHOGRAPHY IN CHRONIC LOBAR COLLAPSE*

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WHEN a lobe undergoes a decrease in volume, such as by atelectasis after occlusion of the bronchus, there remains a certain amount of dead space in the pleural cavity within which is exerted a greater negative intrapleural pressure.[10] Various well known compensatory phenomena come into play to obliterate the pleural dead space. Among the anatomic readjustments which can be seen by roentgenologic means are elevation of the hemidiaphragm and narrowing of the costal interspaces on the involved side and shift of various mediastinal structures toward the affected side.[37] In addition, it is well established[2,20,28,38] that a variable degree of compensatory emphysema or compensatory expansion and reshaping of the remaining lobe or lobes on the involved side occurs after collapse or lobectomy. A study of the altered bronchial pattern in the portion of lung which has undergone compensatory expansion and reshaping forms the basis of this presentation. Ballon and Ballon,[3] Churchill and Belsey,[7] Ellis,[11] Overholt[26] and Richards,[27] among others, have called specific attention to the alterations in the bronchographic pattern following collapse. However, systematic, lobe by lobe bronchographic demonstration and discussion of the subject have not been found in the medical literature.

The illustrative bronchograms to be presented were selected from a review of approximately 350 bronchial lipiodol studies made at the Ochsner Clinic and Ochsner Foundation Hospital between 1942 and 1949. The bronchograms were made according to the technique of Adams and Davenport[1] with roentgenoscopic observation during injection. Bronchi of all lobes of both lungs were usually filled at one sitting, and posteroanterior and right and left anterior oblique roentgenograms were routinely made. The system of bronchial nomenclature outlined by Adams and Davenport[1] in 1942 (Table 1) has been used. Wherever possible in the following discussion the name of a bronchopulmonary segment by the Adams and Davenport system will be followed by the corresponding name in the Jackson and Huber system[15] of nomenclature and the similar numerical designation of Boyden's system[5] of terminology.

Many excellent papers have been published on the roentgenologic observations in pulmonary collapse or atelectasis beginning with such early publications as those of Ritvo,[29] Holmes,[14] and Manges[22] in 1924, Golden,[12] and Jackson and Lee[16]

TABLE I

STRUCTURAL ANATOMY OF THE LUNG
(Courtesy of Adams and Davenport[1])

Lobe	Division	Segment
Left Upper	Apical	Anterosuperior
		Posterosuperior
		Lateral
		Anteroinferior
	Lingular	Anterolateral
		Posteromedial
Left Lower	Dorsal	
	Basal	Anteromedial
		Posteromedial
		Anterolateral
		Posterolateral
Right Upper		Anterosuperior
		Posterosuperior
		Lateral
		Anteroinferior
Right Middle		Anteromedial
		Posterolateral
Right Lower	Dorsal	
	Basal	Anteromedial
		Posteromedial
		Anterolateral
		Posterolateral

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in 1925; and Churchill and Holmes[8] in 1927. The series of papers published by Robbins and Hale[30–35] in 1945 presented a particularly complete description of the roentgenologic observations in collapse of all the respective lobes and pulmonary segments. Thorough familiarity with such observations makes it much easier to predict and to understand the alterations in the bronchographic pattern which accompany collapse or resection of a lobe.

The term "collapse" will be used in this discussion as an inclusive one in order to avoid unnecessary repetition of the words "atelectasis" and "collapse." Collapse will refer to the reduction in size of a portion of lung, whether it be due to fibrosis or other disease acting from within, to a compressive or adhesive force acting from without, or to absorption of air from the affected portion of the lung. The collapse or underlying disease may be assumed to be of fairly long standing; otherwise, a bronchogram would not have been made. The term "compensatory expansion"[26] is used in preference to "compensatory emphysema" for reasons to be mentioned in the discussion.

LEFT UPPER LOBE COLLAPSE

When the left upper lobe becomes collapsed, it tends to fan into the pleural space along the anteromedial margin of the superior mediastinum, producing in this area an opacity of variable size depending upon the degree of collapse. The trachea may be deviated to the left and the anterior portion of the left hemidiaphragm may be elevated. The left hilar shadow and the left main stem bronchus will usually be elevated. Bronchograms (Fig. 1) will verify the elevation of the left main stem bronchus revealing that it angles away from the midline at almost 90 degrees instead of at the normal angle of about 40 degrees. The superior arching of the main stem bronchus may be so great that the bronchoscopist is unable to view the bifurcation into upper and lower lobe bronchi. On the bronchogram the occluded left upper lobe bronchus may often be seen as a small cone or dimple filled with opaque oil (Fig. 1, 2 and 3). At this same point, which is usually about 5 cm. from the carina, the lower lobe bronchus takes its origin and shortly gives off the dorsal division bronchus. It then descends as the basal division bronchus until it branches into the basal segmental bronchi. The sharp inferior angulation of the basal division bronchus seen in Figure 1 is considered a most helpful indication of left upper lobe collapse.

After left upper lobe collapse or lobectomy the left lower lobe must accommodate itself to the remaining pleural space by compensatory expansion and an upward shift and change in shape. These changes are manifested indirectly by the altered bronchial pattern in the lobe. First, one can often detect on the bronchogram directional changes in the basal segmental bronchi of the lower lobe and an upward shift of the subsuperior or subapical bronchi (Fig. 1) if they are present. Much more striking, however, is the rearrangement of the bronchi of the important dorsal division (superior segment, Jackson and Huber; B^6, Boyden) of the left lower lobe which accommodates itself to the apex of the pleural cavity. This division comprises roughly the superior third or half of the lower lobe. The superior displacement of the dorsal division is revealed on the posteroanterior bronchogram shown in Figure 1 by the elevation of the mouth of the dorsal division bronchus. Actually fanning out of the the dorsal division bronchi in the case shown in Figure 1 was not present because the bronchi of this division were involved with bronchiectasis and the division was consequently reduced in size to some extent. At the time of operation, the left upper lobe was small because of long standing and pronounced collapse and was removed along with the dorsal division of the lower lobe, the latter showing bronchiectasis and only fair expansion.

Figure 2 is the bronchogram of another patient with left upper lobe collapse in

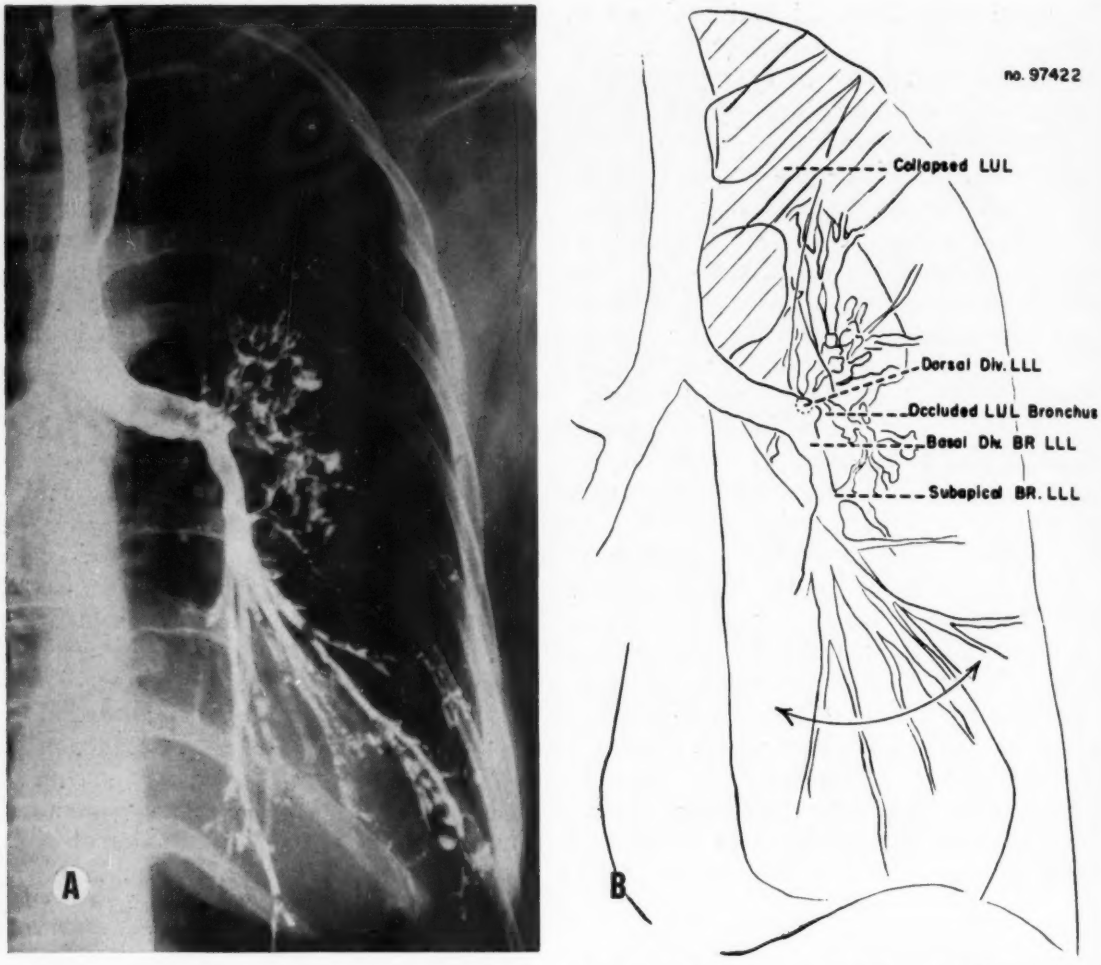

FIG. 1. Case 1. (*A*) Posteroanterior bronchogram* of left lung and (*B*) line drawing of chronic left upper lobe collapse and bronchiectasis of dorsal division of left lower lobe, proved by lobectomy and segmental resection, and pathologic examination. Bronchographic observations: elevation of left main stem bronchus; blind end of occluded left upper lobe bronchus; straight inferior direction of basal division bronchus of left lower lobe; bronchiectasis of dorsal division bronchi of lower lobe. Note elevation of mouth of this bronchus with result that in this projection it appears to branch off before the upper lobe bronchus.

which the dorsal division bronchus of the lower lobe is directed superiorly and its branches are fanned out into the residual pleural space at the apex. Because the dorsal bronchus usually arises within 1 centimeter of the point of origin of the main lower lobe bronchus[18] and because its bronchial branches (particularly the superior or B^6b and lateral or B^6c branches, Boyden[4]) are now distributed to the upper half of the pulmonary field, it is possible at first glance to mistake them for upper lobe bronchi particularly on the posteroanterior bronchogram. Usually either the right or left oblique bronchogram will show to better advantage the superior angulation of the dorsal division bronchus about 1 cm. beyond the stump of the occluded upper lobe bronchus (Fig. 3).

Figure 3 illustrates, however, that the left upper lobe bronchial stump is not always in the position one would expect, namely, at the superior lateral tip of the end of the left main stem bronchus. Instead, in the case shown in Figure 3 (and in

* Posteroanterior and right and left anterior oblique projections refer to position of patient for roentgenography. Film reproductions and drawings are reversed to produce effects of patient facing the viewer.

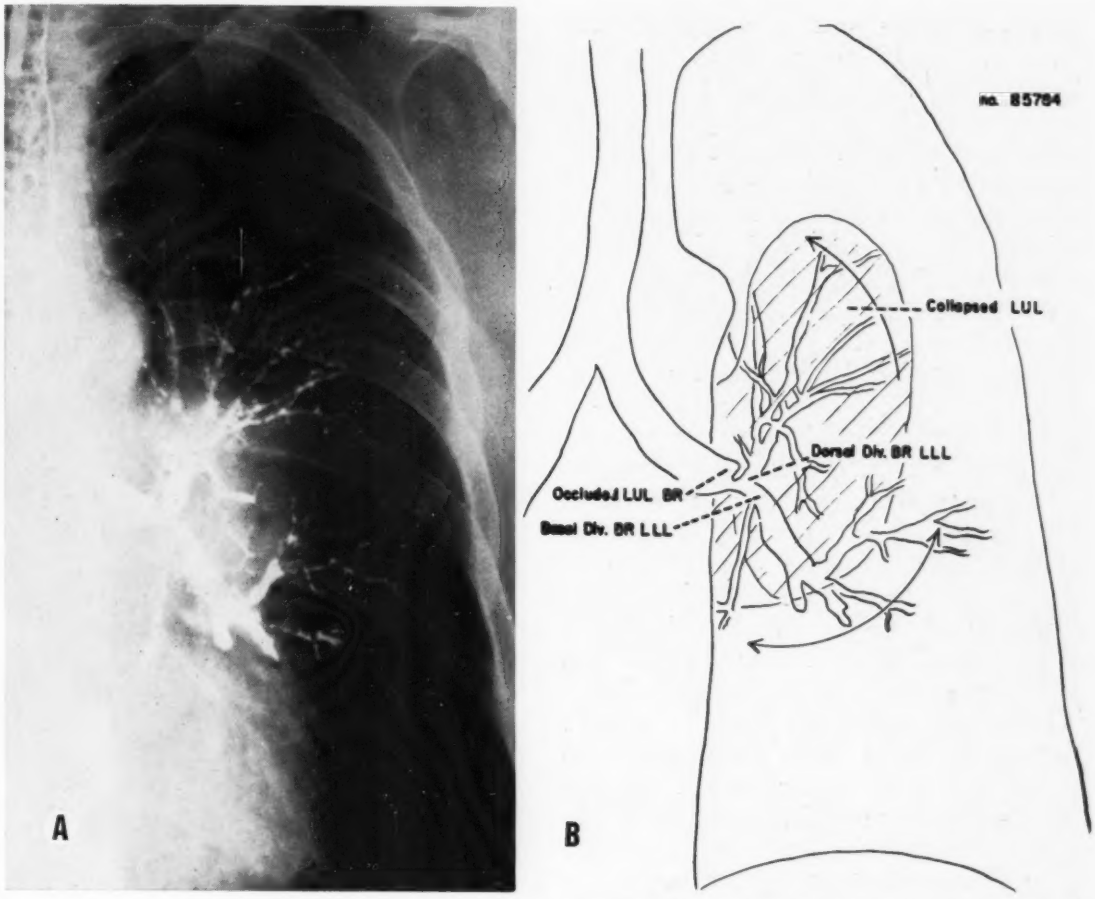

Fig. 2. Case 11. (*A*) Posteroanterior bronchogram and (*B*) tracing of left lung showing complete occlusion of upper lobe bronchus by bronchogenic carcinoma at hilus. Pneumonectomy performed, and upper lobe collapse and occlusion confirmed. Bronchographic observations: lipiodol in mouth of occluded upper lobe bronchus; superior course of main dorsal division bronchus of lower lobe and fanning out of its branches toward the apex; incomplete filling of basal division bronchi of lower lobe but obviously the entire left base is aerated by basal division.

several of the other cases in the series), the left upper lobe bronchial stump has a position inferior to the mouth of the dorsal division bronchus of the lower lobe. Such a reversal of position of the two structures can be accounted for by fixation of the upper lobe bronchial stump in the hilus by neoplasm or by subpleural burial of the stump at lobectomy and by the superior displacement and/or rotation of the dorsal division bronchus as this division of the lower lobe moves toward the apex of the pleural cavity. The odd location of the upper lobe bronchial stump just described may be confusing to the bronchoscopist as well as to the roentgenologist unless both are aware of the distorted relationships. The value of bronchography in working out the distorted bronchial pattern in such cases is apparent.

In summary, the bronchographic observations in left upper lobe collapse or lobectomy are: (a) superior displacement and curvature of the left main stem bronchus; (b) visualization frequently of the stump of the occluded or ligated main upper lobe bronchus; (c) inferior angulation of the basal division bronchus of the lower lobe with variable directional changes of the basal segmental bronchi; and (d) superior displacement and angulation of the main dorsal division bronchus of the lower lobe

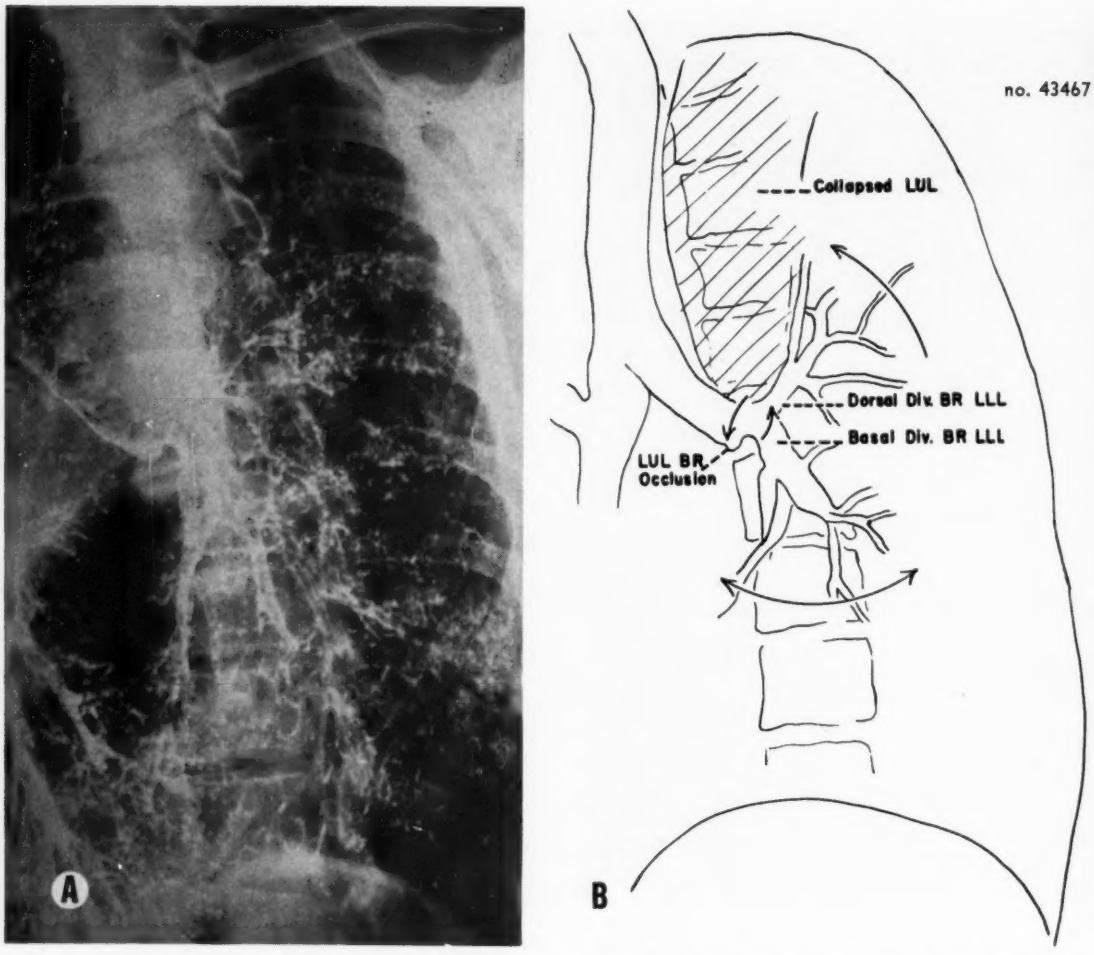

FIG. 3. Case III. (*A*) Left anterior oblique bronchogram and (*B*) line tracing of left lung of left upper lobe bronchial occlusion and collapse due to bronchogenic carcinoma, verified at necropsy. Bronchographic observations: blunt termination of obstructed left upper lobe bronchus; superior shift and rotation of bronchus of dorsal division of lower lobe as indicated by short arrows and fanning out of dorsal division bronchi into the apex; fanning out of basal division bronchi of lower lobe in the left base.

with fanning out of its branches into the residual space in the superior portion of the pleural cavity.

LEFT LOWER LOBE COLLAPSE

Collapse of the left lower lobe produces a right angled, triangular opacity which can be seen through the heart shadow on the posteroanterior roentgenogram provided the exposure is sufficiently great. On the lateral roentgenogram the collaped lobe will appear as a wedge of greater density along the posterior margin of the base of the lung. The posterior portion of the left hemidiaphragm will usually be elevated and the heart may be shifted to the left. The left upper lobe must accommodate itself to the residual pleural space by a general downward shift and compensatory expansion.

Bronchograms in such a case, or after complete surgical removal of the left lower lobe (Fig. 4), demonstrate inferior displacement of the left main stem bronchus and oftentimes a pool of iodized oil in the blind stump of the main lower lobe bronchus. The other bronchographic changes have to do with the rearrangement of the divisions of the left upper lobe bronchus which is displaced inferiorly. The

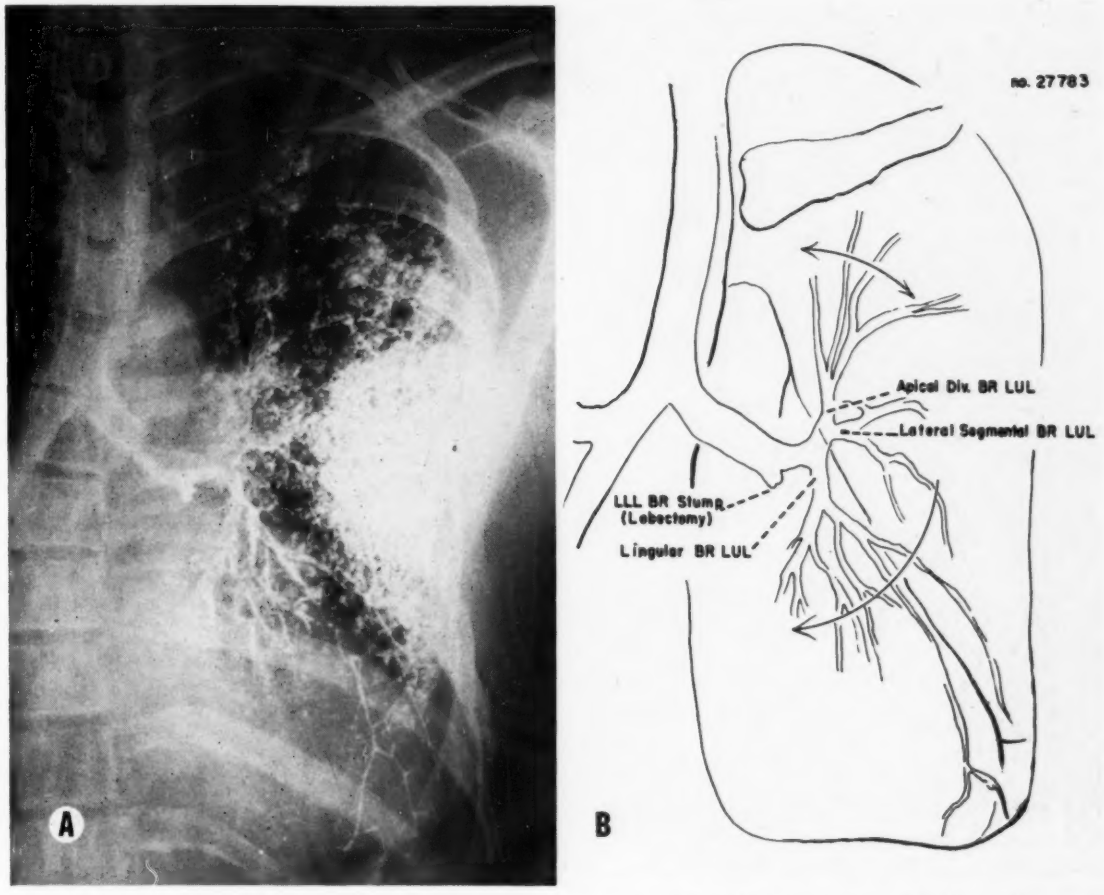

Fig. 4. Case iv. (*A*) Posteroanterior bronchogram of left lung and (*B*) line tracing showing rearranged bronchi of left upper lobe one year after left lower lobectomy. Bronchographic observations: lipiodol in stump of left lower lobe bronchus; fanning out and downward shift of apical and lateral segmental bronchi of upper lobe; straight inferior course of main lingular bronchus and fanning out of its branches across the entire pulmonary base. Note particularly the long attenuated bronchi of anterolateral segment of lingula in the costophrenic angle.

bronchi of the apical division (upper division, Jackson and Huber; B^1 and B^3, Boyden) will be fanned out in the upper pulmonary field, and the bronchi of the lateral segment (B^2, Boyden) will be turned downward to some extent.

The lingular division of the left upper lobe, which is referred to as the counterpart of the right middle lobe, plays a most important part in filling the residual pleural space at the base of the pleural cavity. It will be seen that on the bronchogram shown in Figure 4 the main lingular bronchus is directed straight downward[7,36] and that the bronchi of the two segments of the lingula are fanned out over the entire width of the base of the lung. In one case reviewed in the series in which the left lower lobe and lingula had been removed surgically, a postoperative bronchogram showed a remarkable fanning out of the bronchi of the two apical segments and the lateral segment of the upper lobe. The lateral segmental bronchi in this instance were turned inferiorly in a manner similar to the lingular bronchi at the base illustrated in Figure 4. Attention is called in Figure 4 to the two extremely long bronchial branches of the anterolateral segment (superior segment, Jackson and Huber; B^4, Boyden) of the lingula which extend into the costophrenic angle of the pul-

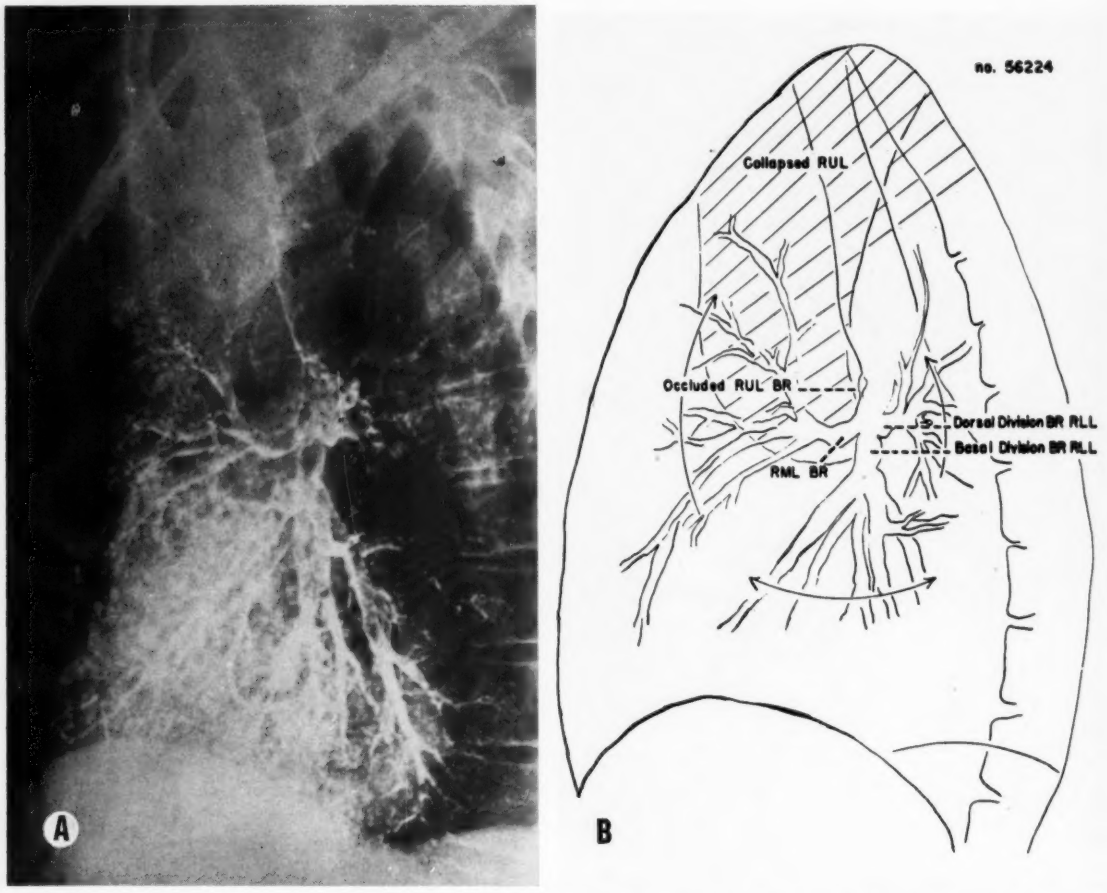

FIG. 5. Case v. (*A*) Left anterior oblique bronchogram and (*B*) tracing of right lung with malignant adenoma producing occlusion of main right upper lobe bronchus and lobar collapse. Proved by bronchoscopic biopsy and pneumonectomy. Bronchographic observations: irregular filling defect at mouth of upper lobe bronchus; superior displacement and fanning around superiorly of right middle lobe bronchi; superior shift of bronchi of dorsal division of right lower lobe; fanning out of bronchi of basal segmental bronchi of lower lobe.

monary base. These bronchi are considered to be actually longer than normal. Such bronchial elongation or stretching has been observed repeatedly in portions of lung which have undergone most pronounced compensatory expansion and spatial readjustment and the diameter of the lumens of such bronchi seems to be reduced by the stretching out process. Postoperative adhesions and obliterative pleuritis undoubtedly play a part in bronchial elongation in the cases of lobectomy, such as in Figure 4.

It should be stated that the bronchial distortion following collapse or excision of the left lower lobe does not produce as confusing a bronchographic picture as in the case of left upper lobe collapse. Therefore, no great difficulty should be encountered in recognizing the condition, particularly if opaque oil is pooled in the lower lobe bronchial stump.

RIGHT UPPER LOBE COLLAPSE

A collapsed right upper lobe produces an opacity along the anteromedial margin of the right upper pulmonary field. The superior displacement of the middle and the lower lobes produces the bronchial distortion which is seen on the bronchogram made after right upper lobe collapse or lobectomy.[28]

The left anterior oblique bronchogram, as shown in Figure 5, usually demonstrates

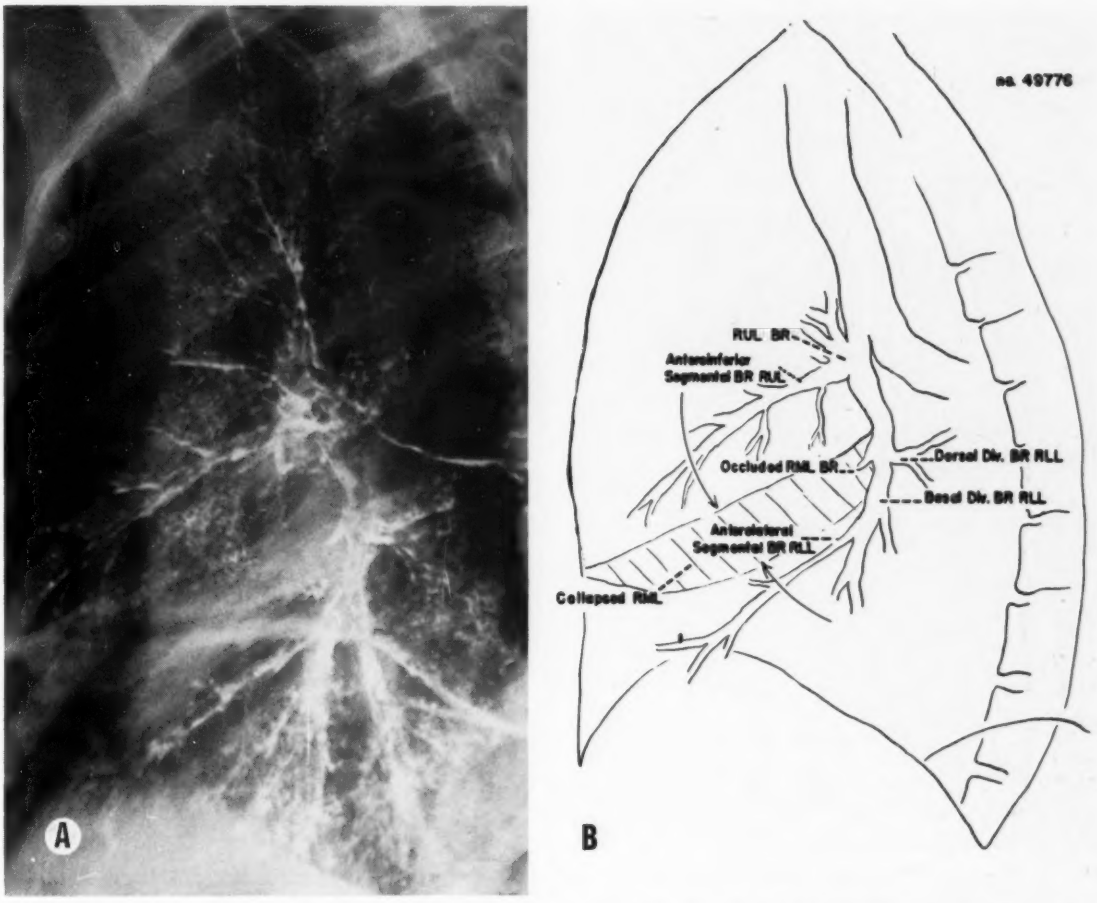

Fig. 6. Case vi. (*A*) Left anterior oblique bronchogram and (*B*) tracing of right lung showing stenosis of right middle lobe bronchus and lobar collapse secondary to irradiation fibrosis verified by repeated bronchoscopies. Bronchoscopic observations: pinching off of main right middle lobe bronchus; inferior shift of bronchi of anteroinferior segment of right upper lobe; slight fanning out of bronchi of basal division of lower lobe.

to best advantage the definite upward sweep of the right middle lobe bronchi which results from upper lobe collapse. The bronchi of the posterolateral segment (lateral, Jackson and Huber; B^4, Boyden) of the middle lobe are the ones with the greatest distortion. The right main stem bronchus and the intermediate bronchus show relatively slight increase in their angulation away from the long axis of the trachea. However, the main middle lobe bronchus arches superiorly before it divides. As on the left side, the important dorsal division (superior, Jackson and Huber; B^6, Boyden) of the right lower lobe which, according to Smith and Boyden[39] composes the upper half or third of the lower lobe, comes into play in filling in the posterior portion of the apex of the pleural cavity (Fig. 5). One notes the superior arching of the dorsal division bronchus opposite the similarly arched middle lobe bronchus and the superior (B^6b, Boyden) and lateral (B^6c, Boyden) branches of the dorsal division extend well into the apex posteriorly. The bronchi of the basal segments of the right lower lobe fan out to a certain extent in the base.

RIGHT MIDDLE LOBE COLLAPSE

It is needless to repeat the description of the familiar observations of right middle lobe collapse on the plain posteroanterior and lateral roentgenograms.[13,34] If there is

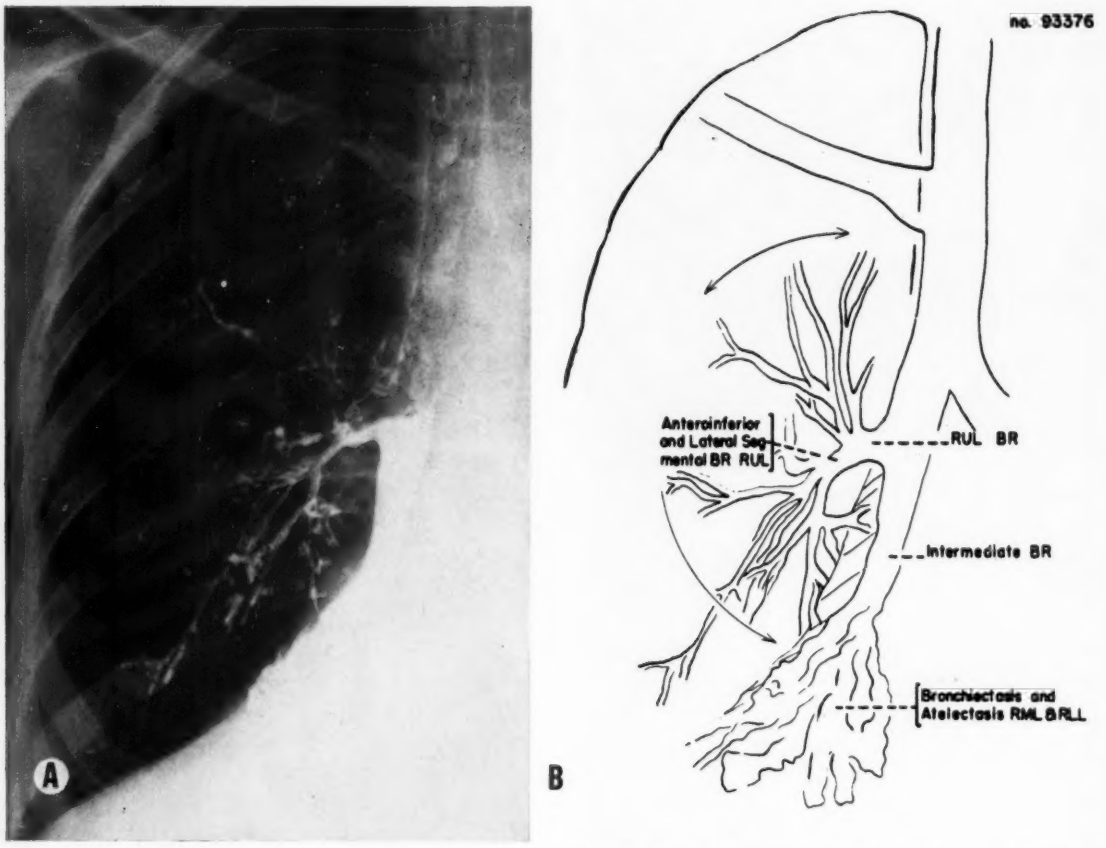

Fig. 7. Case vii. (*A*) Posteroanterior bronchogram and (*B*) tracing of chronic collapse and bronchiectasis of right middle and lower lobes treated by resection of the two lobes. Bronchographic observations: extreme degree of collapse of the middle and lower lobes with fanning together of the bronchiectatic bronchi; almost straight vertical alignment of the trachea, right main stem bronchus and intermediate bronchus; pronounced downward shift of bronchi of anteroinferior segment of right upper lobe and also fanning around of other upper lobe bronchi.

difficulty in distinguishing between interlobar effusion or pleural thickening and middle lobe disease or if the bronchoscopist is unable to determine the nature of the middle lobe lesion, a bronchogram may give helpful information. The bronchogram may show the actual point of occlusion, as in Figure 6, or it may reveal bronchiectasis in the collapsed lobe or a segment thereof. The left anterior oblique bronchogram which usually demonstrates the middle lobe bronchi to best advantage will show the reduced area occupied by the lobe and the opacity resulting from the condensation of its tissues. Because the middle lobe composes less than a third of the total volume of the right lung, it is rather easy for the right upper and lower lobes to move into the space left by the middle lobe collapse. The bronchogram in Figure 6 shows an inferior fanning around of the bronchi of the anteroinferior segment (anterior, Jackson and Huber; B^2, Boyden) of the upper lobe and a slight fanning out of the basal segmental bronchi of the lower lobe, particularly those of the anterolateral segment (anterior-basal, Jackson and Huber; B^8, Boyden) which immediately adjoins the inferior surface of the middle lobe. The bronchi of the dorsal division of the lower lobe may also show some rotation anterolaterally and one should be cautious not to mistake them for middle lobe bronchi since they branch off at the same level but

on the opposite side of the intermediate bronchus.

RIGHT LOWER LOBE COLLAPSE AND COMBINED RIGHT MIDDLE AND LOWER LOBE COLLAPSE

Right lower lobe collapse produces the familiar triangular opacity in the right cardiophrenic angle on the plain posteroanterior roentgenogram. Collapse of both the middle and lower lobes produces a similar but perhaps larger opacity with more distortion of the transverse and oblique interlobar fissures and greater elevation of the right hemidiaphragm. The intermediate bronchus on the right terminates in three major bronchial divisions, consisting of the right middle lobe bronchus and the bronchi of the dorsal and basal divisions of the right lower lobe. Obstructing lesions in this vicinity may produce collapse of any one or any combination of these three bronchopulmonary divisions. Space does not permit illustration of bronchographic patterns in all the various combinations, but it should be mentioned that careful scrutiny of the bronchogram should permit determination of the number of these divisions involved in collapse or other disease.

Figure 7 illustrates the rearrangement of the right upper lobe bronchi which usually results from collapse of the entire right, middle and lower lobes. As the result of long standing collapse with associated bronchiectasis, the right middle and lower lobes in this case are crowded into a relatively small space along the right cardiac border as seen on the posteroanterior view. Moderate elevation of the right leaf of the diaphragm takes up some of the pleural dead space but it is clear from the bronchogram that the right upper lobe plays a major part in occupying the remainder of the right pleural cavity. The lobe shows a general inferior shift and fanning out of its bronchi, but particularly striking is the pronounced inferior extension of the bronchi of the anteroinferior segment (anterior, Jackson and Huber; B^2, Boyden) of the right upper lobe. These bronchi extend well down anteriorly over the dome of the diaphragm. Also the posterior apical segment (posterior, Jackson and Huber; B^3, Boyden) shows an inferior shift. In instances in which the right lower lobe alone is collapsed the middle lobe accommodates itself to the pleural space anteriorly at the base, and consequently the downward shift of upper lobe bronchi is not as pronounced. Where the basal division of the right lower lobe is collapsed the right middle lobe bronchi and the dorsal division bronchi of the lower lobe fan into the base of the pleural cavity.

Collapse of the dorsal division (superior, Jackson and Huber; B^6, Boyden) of either lower lobe produces no great amount of bronchial distortion in adjoining pulmonary tissue. However, bronchi in the posterior portions of both upper and lower lobes will tend to fan into the unoccupied space in the region of the dorsal division. The subapical[23] or subsuperior bronchi of the lower lobe, if present, will angle superiorly and aid in filling in the dead space. The dorsal divisions compose the superior third to one-half of the lower lobes, as is well shown in the color illustrations of Boyden and associates.[39] Their clinical importance has been emphasized by several authors.[17,18,24]

DISCUSSION

An attempt has been made to demonstrate the abnormal bronchographic patterns which result from collapse or removal of the various lobes of the lungs. The rearrangement of the bronchi is most pronounced and confusing in the case of left upper lobe collapse or lobectomy, in which instance the bronchogram reveals that the dorsal division of the left lower lobe moves superiorly toward the apex of the pleural cavity and the basal segments occupy the entire base. The degree of bronchial rearrangement and distortion following collapse is roughly proportional to the volume of the collapsed lobe. For example, the rearrangement of right upper and lower

lobe bronchi is relatively slight following middle lobe collapse as compared with that following left upper lobe collapse. Similarly, collapse of a division or a segment of a lobe will result in distortion of the bronchi in the surrounding lung proportionate to the volume of the particular collapsed portion. Actually, collapse of a single segment usually produces only slight bronchial distortion in the surrounding lung. This does not imply that collapse or disease localized to a bronchopulmonary segment cannot be determined by bronchography. Such segmental disease is recognized by absence of filling or abnormalities of the bronchi of the particular segment. It is only when a division (several segments) or a lobe is collapsed that a significant degree of bronchial rearrangement is detected on the bronchogram and in which the bronchial distortion presents a problem in interpretation.

In this connection it has been helpful to follow Nelson's[24] concept that each lung has four lobes: upper, middle, dorsal and lower on the right and upper, lingular, dorsal and lower on the left. The volume of any one of these eight pulmonary divisions is such that, following collapse or surgical removal of one or more of them, the surrounding lung overexpands sufficiently to produce significant bronchial rearrangement on the bronchogram. Limited space prevents including examples of lingular, dorsal and basal divisional collapse.

It has been the purpose in the cases cited not only to demonstrate the various patterns of bronchial rearrangement, but also to point out that the distorted pattern may actually aid in detecting collapse instead of presenting a confusing bronchographic pattern. The question might be asked, "Why perform bronchography on a patient with lobar or division collapse?" further arguing, "if the condition were not apparent from the plain roentgenograms, then surely laminagraphy or bronchoscopy would demonstrate occlusion of the involved lobar bronchus."

There is no question that laminagraphy would often demonstrate the bronchial occlusion and also the opacity of the collapsed lobe. Unfortunately, this diagnostic procedure was not available in this series. Although its value is unquestioned, the present study serves to demonstrate some of the pitfalls in interpretation of laminagrams in which collapse has considerably distorted the main bronchi even to the point of a 180 degree rotation of the occluded left upper lobe bronchus (Fig. 3).

It has been the general policy in this clinic to employ bronchoscopy in patients in whom lobar or segmental collapse is suspected roentgenologically or a centrally located lesion of undetermined nature is found on the plain roentgenograms. In instances in which the bronchoscopist cannot find a point of occlusion or otherwise furnish a definite diagnosis, bronchography is used as a further diagnostic procedure. Also bronchography is employed wherever bronchiectasis is suspected in association with collapse of a portion of a lung. Furthermore, it has been the general practice in this clinic to perform bronchography as a part of the diagnostic work-up in a great many patients with persistent undiagnosed pulmonary disease, provided there are no contraindications to instillation of iodized oil. The performance of bronchography has not proved to be a hindrance to further observation and treatment of such patients, even though carcinoma may be suspected and surgical measures required within a few days following bronchography.[25] Actually, bronchography has provided the answer to many puzzling problems in which the findings did not conform to the usual configuration and location of a collapsed lobe or in which the opacity of the plain roentgenogram was so small one would not have surmised that an entire lobe or division was involved. Furthermore, the complete mapping of the lungs in nonmalignant collapse is most essential as a preliminary to operation in order to determine the presence, location and extent of bronchiectasis (Fig. 1 and 7). The importance of careful

technique with filling of all lobes warrants special emphasis.

It has been stated that following lobectomy the bronchi in the remaining lobe or lobes on the same side usually assume a pattern similar to that seen following ordinary collapse. Recognition of this fact has both clinical and roentgenologic significance because of the ever increasing frequency of surgical resection of lobes, divisions and even isolated segments of lung. Bronchograms may be required in the postsurgical period in order to investigate the cause of persistent or recurrent clinical symptoms or signs, particularly hemoptysis, or producutive cough such as might originate from residual or new bronchiectasis. In some instances where information as to previous surgical procedures is incomplete, bronchographic mapping of the bronchial tree may give necessary information to the clinician, particularly if additional surgical procedures are contemplated. In any instance of bronchography following resection of a major portion of lung, the roentgenologist will be confronted with a distorted bronchial pattern and the foregoing illustrations may serve as a guide for interpretation.

It should be emphasized, however, that the patterns illustrated in this paper are only the usual or typical ones resulting from collapse or lobectomy. In some instances the distorted patterns may bear little resemblance to those illustrated. The atypical bronchographic patterns are usually due to the complications of extensive pleural thickening or adhesions or pleural effusion or to large intrapulmonary lesions which compress and distort pulmonary tissue, thereby preventing the usual compensatory expansion and re-shaping of the remaining lung. Thus far no mention has been made of the part played by mediastinal herniation of the opposite lung in occupying pleural dead space on the affected side. In many instances such mediastinal hernias may be a significant factor but much more so after pneumonectomy than after lobectomy[28] or lobar collapse.

Physiologic Considerations. It has been intentional in this paper to avoid use of the term "emphysema," as it might be applied to the compensatory expansion which occurs in the other lobe or lobes following collapse or lobectomy. The simple term "compensatory expansion"[26] has been used, as it avoids the implication that true emphysema is present. The designations "compensatory emphysema" or "complementary emphysema" might just as well have been used provided they are distinguished from true interstitial emphysema in which there is trapping of air in the alveoli, rupture of alveolar walls and impairment of pulmonary function.[20] It has been observed that the bronchi in the lung showing compensatory expansion do not ordinarily show a "leafless tree" pattern or poor "dynamism," such as di Rienzo[9] describes in true emphysema. It is also interesting that the various segments and divisions of overexpanded lung appear to act somewhat selectively and independently in accommodating themselves to added pleural dead space and that the compensatory expansion is more pronounced in the segments immediately adjacent to the collapsed or resected lobe. The lung possesses functional reserve in common with many other vital organs,[19] and compensatory expansion would seem to be a manifestation of such reserve.

Bremer[6] has shown that actual proliferation of new alveoli and bronchi as a compensatory phenomenon occurs only in young animals. In adult animals and probably also in adult humans new bronchopulmonary units are not formed to meet new demands for pulmonary function. Instead, existing air spaces undergo full expansion or compensatory expansion and thus occupy more volume and in some way take on added function. Obviously, true emphysema may develop as a complication in lung showing compensatory expansion.[20]

As compensatory expansion occurs, the bronchi in that portion of lung presumably increase slightly in diameter and in length just as they do on inspiration. This follows

Macklin's[21] concept of the normal bronchial framework resembling branches of a fir tree which on inspiration show an increase in length and caliber and then a decrease in length and caliber on expiration. Macklin also discussed angle changes at points of bronchial branching on inspiration and expiration but did not consider them important in normal respiration. However, it seems possible that angle changes as manifested by fanning out and directional changes of bronchi in the cases presented, might play a significant part in the compensatory expansion. It is logical to assume that the blood vessels and lymphatics accompany the bronchi as they become distorted and rearranged. In some cases pleural adhesions or obliterative pleuritis, especially after operation, may produce actual stretching out or attenuation of bronchi and there may be a proportionate narrowing of the bronchial lumens.

SUMMARY

Although lobar and segmental pulmonary collapse or other disease may usually be localized by ordinary roentgenologic means, there are many occasions when bronchography may give confirmatory and additional information. In other instances, chronic collapse may not be suspected until after bronchographic study. In the presence of collapse of a lobe, the remainder of the lung on the affected side will ordinarily undergo compensatory expansion in order to fill in the pleural dead space. The bronchi in the overexpanded lung undergo directional change, especially a fanning around movement, as can be demonstrated bronchographically. Illustrations and descriptions of such bronchial rearrangement as it occurs in the various lobes have been presented. The most striking and confusing bronchial rearrangement occurs in the left lower lobe following collapse or lobectomy of the left upper lobe. The bronchial rearrangements which result from collapse of the other lobes are not as pronounced or confusing as in the case of the left upper lobe. With the increasing frequency of lobar and segmental resection of lung, roentgenologists are more and more apt to be confronted with distorted bronchial patterns in instances in which postoperative bronchograms have been made. The patterns following lobectomy closely resemble those resulting from collapse of the corresponding lobe.

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TRANSDIAPHRAGMATIC DUPLICATION OF THE ALIMENTARY TRACT*

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DUPLICATIONS of the alimentary tract have been reported and discussed sporadically for many years. Only 5 cases of duplications which penetrate the diaphragm and communicate with the small intestine have been recorded. We present this patient in whom a large alimentary duplication penetrated the right crus of the diaphragm and communicated with the jejunum; in addition, there was malrotation of the midgut. This is the second example of this triad of duplication of the alimentary tract with penetration of the diaphragm and malrotation of the midgut.

GENERAL CHARACTERISTICS

Duplications at all levels of the alimentary tract, from hypopharynx to rectum, have been reported in detail. They may be cystic, tubular or tubulocystic structures varying in their degrees of differentiation from simple cysts through more complex variations to near perfect facsimiles of alimentary organs.[17,30,45] They may lie at a slight distance from normal gut or be contiguous to it, even sharing common serosal and muscular layers. The lumen of the duplication may communicate with that of the normal gut, at one or more points, or may be completely separate.[5,24] Size ranges from diameters of a few centimeters to lengths of several meters.[29,33] The cystic lesions tend to have thinner walls probably owing to the accumulation of fluid under tension. Mucosal lining of the duplication may simulate or duplicate that of any portion: esophageal, gastric, duodenal, intestinal, colonic or biliary.[13] The level of occurrence apparently bears no direct relationship to the type of mucosa in the duplication; one or a combination of types may be present. The integrity of the lining may be altered by tension, inflammation or chemical reaction.[37] Respiratory epithelium occasionally is present in the wall or lining.[1,27] Incidence of concomitant anomalies is high with spina bifida and hemivertebra quite common; patent foramen ovale, hydrocephalus, meningocele and multiple duplications are also reported.[3,34] The lesions usually make themselves known early; symptoms begin before the age of five or six, most often in the neonatal stage. In several cases symptoms have begun during the second and third decades[27,29,40,42] and at least 2 cases during the fifth and sixth decades.[1,31]

In the abdomen the most common site is adjacent to small intestine, particularly the ileum.[10,13,38] The tubular duplicates tend to parallel the normal gut, lying between the layers of the mesentery, often communicating with the tract at one or both ends.[13,24,38] Their blood supply is that of normal gut. The cystic variety, which may be large, also lie in the mesentery. Mural structures of both types mimic that of contiguous gut but mucosal lining varies. Gastric mucosa has been present quite frequently, a fact of considerable importance for the occurrence of symptoms and complications of peptic ulcer seems to parallel its incidence closely. Obstructive signs and symptoms are produced by impingement of larger lesions on the gut or result from their participation in a volvulus, torsion or intussusception.[20,25,35,38] Pachman[36] has indicated that small cystic or sessile intramural lesions are frequently found in the ileocecal region, where they may be associated with an intussusception.

Olenik and Tandatnick[33] stated in 1946 that 74 cases of intrathoracic cysts of foregut origin had been reported since 1870. An incomplete review of the more recent literature indicates that at least 28 cases

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of abdominal and thoracic duplications have been reported since 1946. That half of these were wholly or partially thoracic in location is undoubtedly a result of the increase in thoracic exploration by surgeons. The cystic type is by far the most common in the chest but lesions of tubulocystic type also occur. Cysts may be of any size; the tubulocystic variety may extend from high in the neck to the diaphragm.[8,14,18,26,27] They are invariably mediastinal, usually posterior to the midcoronal plane of the thorax. They are fixed by prevertebral and mediastinal tissues, derive their blood supply from adjacent vessels and have no true serosa of their own. Posterior, right-sided location predominates, though a few have occurred in the anterior half of the mediastinum and a few on the left.[3,12,42] Clinical signs are those of compression or intracystic pressure or peptic ulceration with perforation into bronchi and vessels: chest pain, cough, dyspnea and/or hemoptysis. There may also be symptoms referable to associated acute or chronic lung infection—pneumonia, bronchiectasis, pleural effusion—or bronchial obstruction and pressure erosion with cough and sputum.[12,14,44]

With this brief review of the pertinent literature as a background, we present a case which we believe will be of unusual interest to all, but to radiologists in particular, because of the unusual features of the roentgen appearance.

REPORT OF CASE*

C. B., a white girl, aged five and a half, was admitted to The New York Hospital for the second time on April 9, 1951, this time in a state of severe shock. A supine portable film of her chest demonstrated an abnormal, smooth shadow, whose center was radiolucent, in the right hemithorax, extending from the superior thoracic inlet to the diaphragm. Skeletal anomalies were also noted (Fig. 1). A film in decubitus position demonstrated gas and fluid within the structure and a film of the abdomen showed gas and fluid-dilated loops

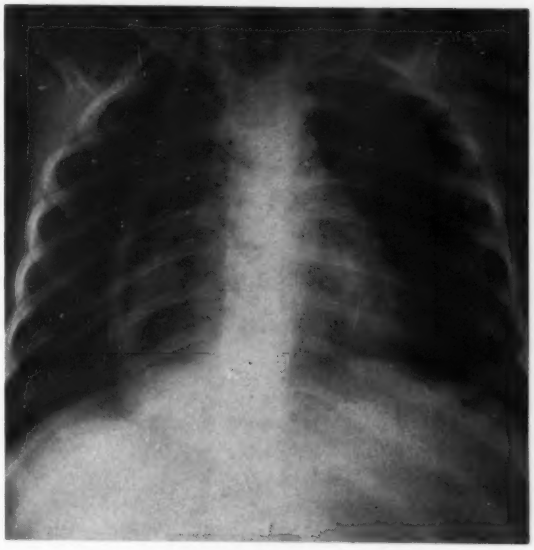

Fig. 1. Portable supine chest film made at time of second admission. Small intestinal obstruction, caused by abdominal adhesions, resulted in distention of smooth-walled right posterior mediastinal structure. Note cervical spina bifida, upper dorsal hemivertebrae, and failure of segmentation of ribs.

of small intestine. In an attempt to explain the abnormal appearance of both chest and abdomen, a diagnosis of herniation of small intestine through the esophageal hiatus with incarceration and obstruction was made.

When the patient had responded satisfactorily to antishock therapy, her abdomen was explored surgically. Intestinal obstruction, due to adhesions at an old surgical scar, and two-finger dilatation of the esophageal hiatus were found. No bowel was actually seen in the hiatus, but it was thought likely that hiatus hernia had been present before surgical exposure and had reduced spontaneously. The obstruction was relieved but the patient's condition (which had been poor) became precarious, preventing further exploration and repair of the relaxed esophageal hiatus.

The following day, semi-upright and lateral recumbent portable chest films again showed a gas and fluid-filled structure in the same location, now somewhat smaller (Fig. 2). It was decided that this represented a recurrent herniation of bowel through the relaxed esophageal hiatus and it was planned to repair this when the patient's condition had improved sufficiently.

At this point, the case and films were re-

* Presented before the meeting of the New York Roentgen Society, New York Academy of Medicine, May 21, 1951.

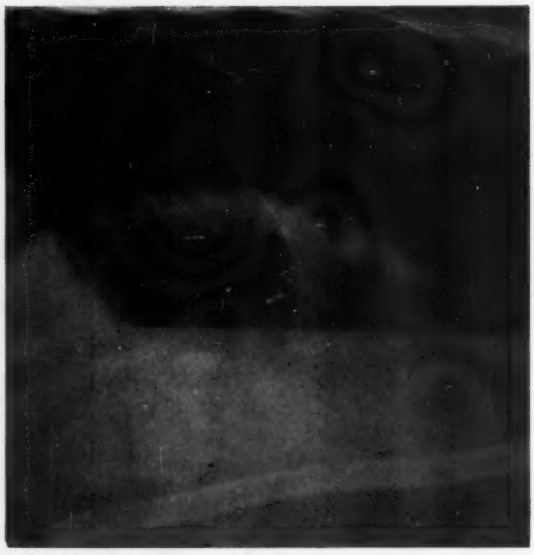

FIG. 2. Lateral recumbent film made twenty-four hours after release of intestinal obstruction. The thoracic lesion, now slightly smaller, is still distended by gas and fluid. Note that anterior mediastinal organs have sagged below the spine, increasing exposure of the lesion.

viewed with Dr. John Caffey who suggested that the findings were similar to those in the patients reported by Gross, Neuhauser and Longino[18] and that the mediastinum be explored surgically.

It seemed logical to carry out further roentgen study of the small intestine. This was done some days later when the patient's condition had improved.

FIG. 3. Colon study during first admission. Malrotation of the midgut; left-sided colon with low midline cecum.

Several facts in the child's past history were of interest in this connection:

1. She had been subject to severe episodic lower and mid-abdominal pain, unrelated to meals, since the age of two and a half, the onset of which was felt to have coincided with the birth of a sibling.

2. Exploratory laparotomy at an outside hospital, performed at the age of four and a half, revealed only anomalous position of the bowel. An appendicectomy was performed, but pain continued unabated.

3. Blood was passed in the feces several times.

4. Two outside roentgen alimentary studies had shown only malrotation of large and small intestine.

5. A chest roentgenogram by an outside physician was interpreted as showing "widening of the base of the heart."

6. At the time of her first admission to The New York Hospital (aged five), physical examination was not remarkable. She was mildly anemic; stools were positive for occult blood. A chest roentgenogram was taken but was lost owing to clerical error. A colon examination and upper gastrointestinal study showed the malrotation of the midgut noted previously (Fig. 3). Though there were historical features suggestive of a psycho-emotional cause, exploratory laparotomy was undertaken in an attempt to find and remove the cause of the abdominal pain and the blood in the stools. Despite thorough surgical exploration, a cause was not found.

7. Following discharge, she was well until five days before her second admission, at which time fluctuating abdominal pain and occasional vomiting of dark brown material began. At home, the child was discovered lying semicomatose in bed one morning and readmitted to the hospital.

When she had recovered from her intestinal obstruction and subsequent operation, the small intestine was examined roentgenographically. First examination, with only a few mouthfuls of barium-water mixture, showed nothing remarkable. Later, a full 180–200 cc. was gulped in a matter of seconds. Roentgenoscopy showed the stomach to be well distended. Fifteen minutes later the roentgeno-

gram shown in Figure 4 was taken. In the original a faint trail of white flecks led upward along the right spinal border, apparently from a point somewhere below the duodenum, to join the collection of barium above the diaphragm. The following day, barium remained in the intrathoracic structure but had left the upper gastrointestinal tract (Fig. 5 and 6). We felt that this constituted solid confirmation of the suggested diagnosis: communicating alimentary duplication whose thoracic component penetrated the right leaf of the diaphragm to lie in the posterior mediastinum.

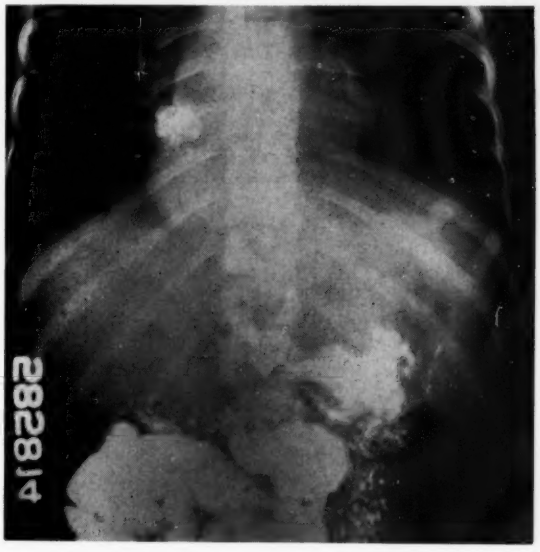

Fig. 4. Small intestinal study. Most of the barium is in middle portion of right-sided small intestine at fifteen minutes. In the original film, a faint trail of white flecks extended up along the right margin of the spine to join the supradiaphragmatic barium collection. The latter lies within the abnormal thoracic density but overlaps the right border of the heart, which is clearly shown by the well penetrated Bucky exposure (compare with Fig. 5).

The surgeons agreed to re-explore the abdomen and then explore the mediastinum. On April 30, 1951, through a right subcostal and later a right anterolateral chest incision, the lesion diagrammed in Figure 7 was removed by Dr. William A. Barnes and Dr. James E. Davis. A thickening was felt in the mesentery of the first jejunal loop. This proved to be the lower portion of the long tubular intra-abdominal "stalk," 1.5 cm. in diameter, which was attached to the small antechamber applied to the mesenteric side of the jejunum (Fig. 8).

Fig. 5. Upright conventional chest film made twenty-four hours after film of Fig. 4. Barium remains in lower part of thoracic structure which has a gas-fluid level in its upper part (arrow). Fluid in duplication tends to obscure the right border of the heart.

Through a small opening near its proximal end, the antechamber was in communication with the jejunum and through another in its roof, with the lumen of the stalk. The latter proceeded cephalad and dorsad between the leaves

Fig. 6. Lateral view. Note vague posterior mediastinal density, gas-fluid level (arrow) and gas pocket, and barium outlining lower chamber of duplication.

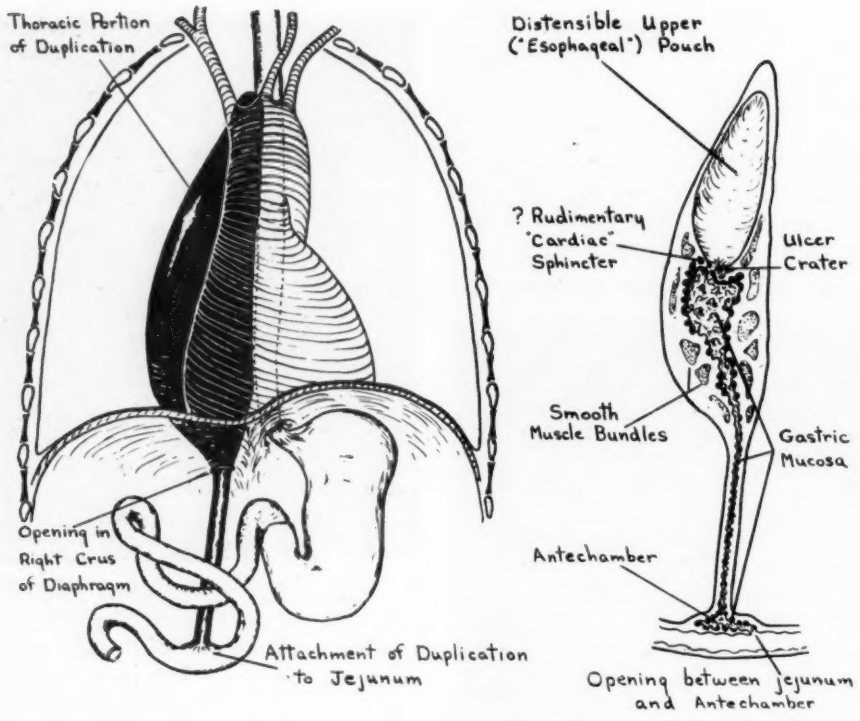

FIG. 7

FIG. 8. Operation: abdominal phase. The surgeon holds the jejunal loop; the mesentery has been dissected away exposing the antechamber and tubular stalk which runs dorsad and cephalad (thorax is to left).

FIG. 9. Operation: thoracic phase. The bulbous thoracic portion of duplication is held anterior to partially re-expanded lung prior to removal of specimen (abdomen to right).

of the mesentery, behind the liver, and up through a small posterior hiatus in the right diaphragm which was rather firmly adherent to it. Above the diaphragm, the structure became bulbous and was 7 cm. in maximum diameter. It lay in typical position, *i.e.*, behind the lung root, in contact with the right side of the spine and behind the pleura. Its superior extremity lay high in the mediastinum attached by a small fibrous band to prevertebral tissues (Fig. 9). It was not possible to determine its exact relationship to the esophagus; conceivably, it may have been attached to this at a point higher up. Its blood supply came from vessels along its course, some coming directly from the aorta.

Fig. 10. (Courtesy Dr. J. M. Pearce.) Specimen following removal. The constricted area in the stalk is point of section to facilitate removal. Portion below arrow was infradiaphragmatic.

Fig. 11. (Courtesy Dr. J. M. Pearce.) Upper half of stalk and entire thoracic portion after dissection. Left arrow points to narrow neck (widened by dissection) between esophageal and gastric chambers. Right arrow points to ulcer. Note smooth mucosa of upper chamber with blood beneath part, rugose lining of lower chamber and stalk.

Upon opening the specimen, the bulbous portion was seen to contain a thin-walled (3 mm.) upper chamber with a smooth inner surface separated by a narrow neck from a thick-walled (1–2 cm.) irregular lower chamber, having a rugose-appearing inner surface. Gas in the upper chamber probably accounted for most of the radiolucent shadow during the obstructive episode. Bundles of muscle were

present in the walls of both, including several small bundles about the narrow neck, which suggested the presence of a primitive sphincter. Its lumen was patent from the jejunum to the top of the upper chamber; thin bloody fluid was obtained from its upper chamber, thicker, mucoid, bloody fluid from its lower chamber. There was a 5 mm. ulcer crater with raised, rolled edges immediately inside the opening to the upper chamber; the latter showed blood in its lateral wall. When removed, the specimen was 27 cm. long (Fig. 10 and 11).

Dr. John M. Pearce examined various portions microscopically and reported these findings: The antechamber, stalk, and lower chamber were lined by normal gastric mucosa with mucus-producing and acidophilic columnar cells and Paneth cells. The ulcer crater extended through the mucosa and submucosa to the muscularis; its base was covered with fibrin. The upper chamber was lined by stratified squamous epithelium similar to that in a normal esophagus. There was fibrous tissue and regularly arranged smooth muscle in the wall of the upper chamber with a row of mucus glands in loose fibrous tissue which resembled bronchial glands more than esophageal glands.

One month later the patient had had no pain and was in a good health and spirits.

DISCUSSION AND REVIEW OF THE LITERATURE

The cause of these lesions remains a mystery though some rather credible explanations of pathogenesis have been offered. Extensive discussion has been recorded.[2,5,14,21,22] In summary, those currently popular are:

1. The vacuole persistence theory, generally attributed to Keith[22] and Bremer[5]: Epithelial proliferation of the lining of the primitive gut obliterates its lumen at an early stage (six weeks). Normally, coalescence of vacuoles (which appear soon afterwards) re-establishes patency. Failure of complete coalescence (which can occur at any level) results in atresia or lateral isolation of vacuole clusters may result in formation of a duplicate. Degree of separation of the clusters (and possibly, influence of growth or organizer substances) determines whether resulting duplicate is a separate structure at a distance or shares common muscular and serosal coats, with lumina separated only by two mucosal layers. Accumulation of secretions and chemical action conceivably could account for perforation of such a partition and produce communication.

2. Lewis and Thyng[28] have described the occurrence of diverticula along the course of the embryonic gut, which normally disappear. It has been postulated that "pinching off" of these might occur.

3. "Sequestration of embryonic multipotential entodermal cells from the lung bud area of the primitive alimentary anlage, with later growth and development," has been listed by Cassel and coworkers[9] as an explanation.

4. The "twinning" theory, as applied to teratoid lesions.

5. Origin from the omphalomesenteric system.

Grove and Porch[19] reported a case of duplication of terminal ileum with an associated Meckel's diverticulum and an "intramesenteric diverticulum" which is, perhaps, evidence against the last theory. Our personal inclination is to favor some version of the "vacuole persistence" formulation as best able to explain the wide variety of duplications. Conceivably, the more extensive lesions, *with* gut communication, become essentially tubular structures while those with *no* communication become rounded and cystic by reason of retention of fluid secreted from their walls.[10] It is conceivable, too, that communications may seal off as a result of chemical inflammation. Sealing off of a formerly patent communication, with resultant distention, may account for the rare case in which pressure symptoms first develop long after the neonatal stage. However, the occurrence of bronchial elements may be related to the formation of the lung buds as evaginations from the primitive foregut in the fourth week of embryonic life, perhaps adding weight to the third theory.

Despite Ladd's[23] hope of simplifying the nomenclature of this group of lesions by

suggesting in 1937 that they all be classified under the generic title, Duplications of the Alimentary Tract, at least a dozen designations are still used, *i.e.*, accessory stomach, enteric cyst, enterocystoma, enterogenous cyst, foregut cyst, gastric cyst, gastroenteric cyst, giant diverticula, mediastinal cyst of gastric origin, of enteric origin, etc. Ladd,[23] and Ladd and Gross[24] have suggested logical reasons for discontinuing the use of such terms. We agree with Ladd and Gross. We suggest that the general term "duplication" be enlarged upon, suitably, by use of appropriate regional or morphologic adjectives such as cystic thoracic duplication of alimentary tract or alimentary duplication of thoracoabdominal type, etc.

Owing to the nature of the lesions reported, the approach of most authors has been from a single aspect only with certain notable exceptions.[13,15,23,24] A sizeable number of isolated intrathoracic *or* intraabdominal lesions have now been recorded. In the light of the present case, brief mention of selected case reports from the literature seems pertinent.

In 1933, Poncher and Milles[37] reported a case of intramesenteric diverticulum of the ileum containing gastric mucosa in which there were two mediastinal cysts containing gastric mucosa. No connection between abdominal lesion and the two mediastinal cysts was described. They cited several similar cases reported in the European literature. In all cases there were independent duplicative elements above and below the diaphragm.

In 1946, Dickson, Clagett and MacDonald,[12] and Valle and White[43] reported separate single cases of lesions which perforated the diaphragm, were embedded in it and extended relatively short distances above and below, ending blindly. In 1950, Langston, Tuttle and Patton[27] reported a case of a thoracic alimentary duplication which extended from a point high in the neck to the abdomen, ending 8 cm. below the diaphragm. None of these had a "normal" anatomical connection with the alimentary tract. These are examples of lesions which cross the boundary between chest and abdomen.

Black and Benjamin[4] carry the picture a step further. In 1936 they reported an elongated "retromediastinal cyst" which extended from the third dorsal vertebra, through the left leaf of the diaphragm to end blindly at the level of the twelfth dorsal vertebra. Associated with this was an "accessory intestinal pouch, lying in juxtaposition to the jejunum, 130 centimeters below the ligament of Treitz."

In 1933, Gjörup[17] reported a case of contiguous near-perfect duplication of the esophagus and stomach in a seventeen month old female.

In 1950, three cases similar to our own were reported by Gross, Neuhauser and Longino.[18] In the same year, the cases of Sweet[8] and Fisher[15] were recorded. Billows[3] has provided data on a sixth case treated surgically during 1950. The organoid structure described by us is the seventh of its type, shows the highest degree of differentiation and is the second with concomitant malrotation of the midgut.

The 7 have features common to their own group and to alimentary duplicative lesions in general. Of the 7 cases, all had a patent communication with intestine; 5 communicated inferiorly with jejunum, 1 with duodenum and 1 with ileum; 6 perforated the right crus of the diaphragm; 6 had developmental anomalies of cervical and upper dorsal spine (spina bifida, hemivertebra, "block" vertebra); 5 contained gastric mucosa, resulting in ulceration in 4 and severe reaction in the wall of the structure in the fifth, and the other 2 had symptoms resulting from pressure on mediastinal structures. In 5, the onset of symptoms occurred at four months of age or sooner; onset in the others occurred at two and a half and three years. All were under six years of age at time of surgical treatment. Five of the duplications were successfully removed, with relief of symptoms.

It is not the purpose of this paper to dwell

on the technical aspects of treatment. That has been discussed elsewhere. Surgical removal of even asymptomatic lesions, however accomplished, seems mandatory because of the potential complications of ulceration and hemorrhage.

ROENTGEN FEATURES

That no case, similar to ours, has occurred before 1947 seems hardly credible. Rather, one wonders if those that must have occurred have not been recognized. In any case of duplication of the alimentary tract, early recognition of the nature and extent of the lesion is extremely desirable because of the obvious implications to patient and surgeon.

A case such as the present offers an exceptional opportunity for diagnosis. Apparently, ours is the first to be diagnosed conclusively prior to exploration of the thorax and abdomen. There are features associated with other types of duplicative lesions, however, the recognition of which may allow the radiologist to point the way to correct diagnosis.

Since index of suspicion and percentage of correct diagnoses seem to have a direct relationship, the occurrence of a recognizable anomaly may put one on guard. The frequent occurrence of associated anomalies of the cervical and upper dorsal spine, particularly spina bifida and hemivertebra, is striking.

In the thorax, predominance of right-sided, posterior lesions is outstanding. They may be large and extend laterally from the central shadow but may be small and be obscured by it in frontal view and poorly seen on lateral films. Roentgenoscopy, 30 degree oblique films and heavily penetrated, anteroposterior Bucky films should help to outline the lesion. Laminagraphic studies may aid in delineation. By virtue of position or size of the lesions, compression or displacement of mediastinal structures occurs quite frequently. Obstructive emphysema, atelectasis and displacement of the heart and tracheal air column may be evident. Esophagrams frequently demonstrate compression or displacement of that organ or may show communication, rarely, or double lumen.[16] Certain thoracic or thoraco-abdominal types have anatomical communications with the normal tract; others acquire communication, commonly with bronchi, by peptic ulceration with perforation or pressure erosion. Many of these will contain gas and fluid and well-penetrated upright or decubitus films may demonstrate a gas-fluid level. The appropriate decubitus film may be of particular value owing to the relative mobility of the heart as compared with the duplication. With the patient in lateral recumbent position, the former may drop away exposing the relatively fixed duplication (Fig. 2). Ladd and Gross and Gross, Neuhauser and Longino feel that few cases of contiguous esophageal duplication limited to the thorax have an anatomical communication with the normal esophageal lumen; hence, the finding of gas and fluid in an abnormal thoracic structure in the regions described should lead one to think of a diaphragmatic hernia or duplication of the type presented here.

Bronchography probably has some limited value and may serve to differentiate between cystic pulmonary lesions and cystic duplications. While demonstrating skeletal anomalies, films of the spine and thoracic skeleton may also demonstrate erosion of ribs or vertebrae; such has occurred in several reported cases.[11,26,32,37] It must be borne in mind, of course, that secondary or reactive pulmonary changes, *i.e.*, atelectasis, chemical pneumonitis, bronchiectasis and chronic pneumonia and effusion, may obscure the underlying lesion.

Evidence of abdominal lesions may be gained from plain supine, lateral or upright roentgenograms or by appropriate studies utilizing contrast material. Compression or displacement of the stomach, duodenal loop, large and small intestine and rectum has been demonstrated in various cases.[10,25,26,29] Abnormal gas and fluid-dilated structures may be visible on plain films (Fig. 12*A*) possibly causing partial or complete intestinal obstruction

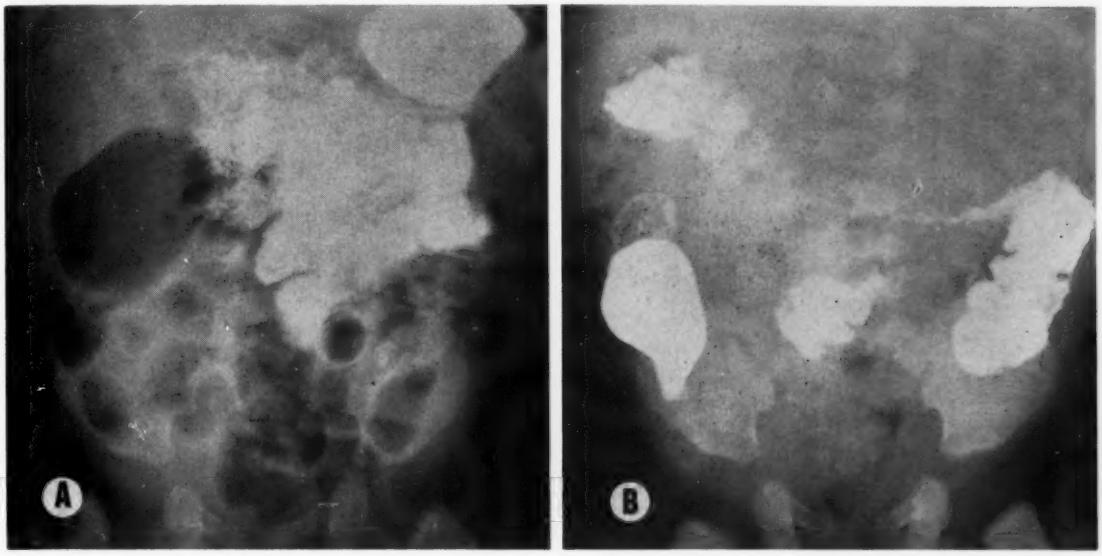

Fig. 12. Cystic duplication adjacent to terminal ileum. A three month old male had had blood in stools for two months, no other symptoms. (*A*) Early film of small intestinal study, showing a large gas dilated structure in right mid-abdomen. (*B*) Late film—structure now filled with barium mixture (intubation unnecessary in this case). Note malrotation of colon with midline cecum, an associated anomaly, which supported correct diagnosis preoperatively. Duplication, lined by gastric mucosa, had a chronic ulcer in its wall.

or there may be free intraperitoneal gas if perforation has occurred.[7,25] We have had a case of small intramural duplication in the proximal jejunum of an adult male which produced clinical and roentgen evidence of intermittent partial intestinal obstruction.

Despite statements to the contrary by several authors, barium occasionally does outline a part or most of the communicating duplications as has been demonstrated. All 7 of the structures discussed communicated with the alimentary tract in the abdomen, and gas was recognized roentgenographically in the thoracic portion of 4. All 7 were studied with barium yet only in 2 was thoraco-abdominal communication demonstrated by the ascent of barium into the thoracic portion. The abdominal portion of 1 was shown as a large saccular formation which was connected to a loop of lower jejunum by a narrow pedicle.[3] In our patient, demonstration of the extent of the lesion probably was dependent upon the fact that the patient swallowed a large amount of barium and that it passed rapidly into and through the small intestine. The resultant momentary rise in pressure within the gut lumen, at the point of communication, was apparently sufficient to overcome the intraluminal pressure of the blind-ended duplication and any possible peristaltic activity in its "stalk."

In accordance with this theory, if a communicating duplication of any type is suspected, a method should be devised to deliver contrast substance at slight pressure, in a steady flow, into the lumen of the segment of suspected communication. This could be accomplished best by intubation of esophagus, colon, or small intestine. The latter was described by Buckstein[6] and later expanded upon by Shiffer[41] and by Schatzki.[39] Such intubation would assure delivery of adequate amounts of contrast substance in infants or children, and would by-pass the unpredictable pyloric sphincter at any age. By use of the small intestinal enema under roentgenoscopic control, or by intubation and obturation, the point of communication might be observed.

Differential diagnosis in the chest would have to include bronchial cyst or diaphragmatic hernia, if the structure contains air,

and possibly extensive necrosis and liquefaction in a neoplasm (this does not seem a likely cause of confusion, however). If fluid-filled, differential diagnosis would be nearly impossible. An associated intrathoracic meningocele confused the picture in 1 of the thoraco-abdominal cases[3] and an associated small intestinal hernia in another.[18] Roentgenographically evident calcification has not been described in any of the cases reviewed.

In the abdomen, differentiation from mesenteric or omental cysts of lymphatic origin or other abdominal tumors would be difficult unless the structure was outlined by gas or barium mixture (Fig. 12, *A* and *B*). However, these lesions are evidently not as rare as once supposed and should be included in differential listing when appropriate findings are present.

SUMMARY

1. General and specific clinical, anatomical, and pathologic features of alimentary tract duplications are reviewed.

2. The seventh example of a recently reported unusual variation of the lesion with penetration of the diaphragm is described.

3. Common features of the seven cases are summarized.

4. Theoretical considerations of pathogenesis are summarized.

5. In a review of the literature, a few pertinent morphologically related cases are described.

6. Ladd's original plea for a uniform system of classification is supported.

7. Roentgen aspects and diagnostic methods are discussed; the value of lateral recumbent films is stressed and it is suggested that intubation of the small intestine will enhance the demonstration of lesions communicating with that segment of the gut.

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For his assistance in the preparation of this manuscript, the author wishes to thank Dr. John Caffey, whose recognition of the lesion roentgenographically led to confirmatory demonstration and surgical removal.

Grateful acknowledgment is also extended to Dr. William Laupus and members of the Pediatric housestaff and to Drs. Barnes and Davis, and Pearce for their cooperation and assistance in obtaining photographs of the lesion.

ADDENDUM

Since our paper was submitted for publication, the surgical findings in the case reported above have been given in a paper by J. E. Davis and W. A. Barnes. Intrathoracic duplications of the alimentary tract communicating with the small intestine. *Ann. Surg.*, 1952, *136*, 287–295.

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VOLVULUS OF THE STOMACH*

REPORT OF A CASE

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TRUE volvulus of the stomach is a relatively rare condition, but it does occur with sufficient frequency that it should not be overlooked as a possible explanation for acute, chronic, or acute and intermittent abdominal symptoms.

This report of a case of gastric volvulus is presented because of interesting and rather unusual roentgenological findings which illustrate all of the important criteria for diagnosis of a true volvulus of the stomach. In addition to the 180 degree volvulus which occurred in one axis of the stomach, there was also an 180 degree rotation of the stomach in the other axis.

INCIDENCE

Berti[2] in 1866 published the first report of a case of volvulus of the stomach, and Buchanan[3] in 1930 found 34 cases reported up to that time. In 1940, Gabor[6] stated that he had found about 75 cases in the literature. A review of the American and British literature since 1940 revealed an additional 25 cases reported as gastric volvulus, including the case presented in this report. However, of these 100 cases, it appears that many should not have been reported as volvulus. Some of them are apparently simple rotations of the stomach without volvulus. Others represent a condition in which the stomach is found in a high transverse position without definite torsion. These should not be classified as volvulus even if the greater curvature is at a higher level than the lesser curvature. In this we agree with the views of Schatzki and Simeone[12] and Hamilton[7] who state that many of the cases reported as volvulus merely show high positions of the stomach with rotation of the entire viscus, or an exaggerated form of the transverse steerhorn type of stomach which may also show various degrees of a cascade effect. Cases of this type are fairly common, occurring mostly in the obese, hypersthenic type of patient and should not be confused with true volvulus. In fact, volvulus is much less apt to occur in this type of patient since the stomach is usually fixed and quite constant in position. This is important since the symptoms and complaints of such a patient may be erroneously ascribed to a roentgenological finding which is normal for that patient and not productive of any symptoms.

PATHOLOGY

The term volvulus implies a twisting of a portion of the intestine or other hollow viscus. Therefore, the roentgen diagnosis of volvulus of the stomach should be reserved for those cases in which a definite spiral of the rugal pattern of the stomach can be demonstrated. This rotation of a portion of the stomach, with a spiral twisting between the involved parts, constitutes the only primary pathology of the condition. Secondary pathological changes consist of various degrees of dilatation of the stomach due to obstruction at the point of torsion, circulatory changes, and edema. Schneider and Bohannon[13] report a case in which 5 liters of mucoid contents were found in the stomach at surgery. The walls of the stomach were 2 centimeters in thickness.

Associated pathological conditions have been reported such as gastric ulcer, hour glass stomach, carcinoma, and benign tumors. In some instances, these conditions were thought to be contributory in the production of the volvulus.

In some cases,[14] the transverse colon or splenic flexure or both are found high in the abdomen, being apparently pulled up by the gastrocolic omentum to a position

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anterior to the stomach, between the latter and the diaphragm. However, this finding is evidently secondary to the volvulus rather than having an etiological relationship. In fact, the abnormally long gastrocolic omentum found in many cases would lessen the probability of the colon being pulled up with the stomach.

ETIOLOGY

The conditions most commonly found associated with volvulus of the stomach are elongated gastrohepatic and gastrocolic omenta, eventration of the diaphragm, and esophageal hiatus hernia.[7,8] Robnett and Jones[10] reported 1 case in which there was absence of the middle third of the gastrocolic omentum along with an esophageal hiatus hernia and another case showing an elongated gastrohepatic omentum. An ulcer of the lesser curvature side of the stomach at the point of torsion was reported in 2 cases.[1,6] Benign or malignant tumors have also been found associated with the volvulus.

A definite etiological relationship between the volvulus and associated pathology would, of course, not be definite in some cases. However, if one or more of the above conditions are found along with a volvulus, it seems likely that the volvulus has occurred as a complication of the other pathology.

Only a few cases can be classified as idiopathic and even in these it is doubtful that a volvulus would have been produced unless there were elongation or some defect of the gastrohepatic or gastrocolic omentum.

CLASSIFICATION

Singleton,[14] in 1940, suggested a descriptive classification of volvulus of the stomach. This classification is followed by most authors and texts and is summarized here for reference, as follows:

1. Axis of rotation
   a. Organo-axial: Rotation occurs on relatively fixed points of esophageal and duodenal openings.
   b. Mesenterio-axial: Rotation on axis of mesenteric attachments of the stomach.
2. Degree of rotation
   a. Complete if torsion is 180 degrees or more.
   b. Incomplete: less than 180 degrees.
3. Direction: Anterior or posterior
4. Etiology
   a. Associated or contributory pathology.
   b. Idiopathic if volvulus occurs without evidence of other pathology.
5. Acute or chronic

Robnett and Jones[10] suggest the use of the terms "idiopathic" for those cases showing no associated or etiological pathology and "complex" for those cases in which other related disease is found. Campbell[4] adds a subclassification of "permanent" when the volvulus is found to be constant rather than intermittent.

The most common type of volvulus is anterior organo-axial and following this classification, the case reported here would be described as chronic, complete, anterior organo-axial with abnormally long gastric omenta.

ROENTGENOLOGICAL CRITERIA

The most common roentgenological findings are as follows:

1. High position of the stomach with a cascade appearance of the cardia.

2. Narrowing or hour glass configuration of the pars media of the stomach with demonstration of definite spiral appearance of the rugae.

3. Greater curvature of the stomach located above the lesser curvature.

4. The pars pylorica and the duodenal bulb point downward and to the right with a wide, low curve of the second and third parts of the duodenum.

Other findings which are mentioned by some authors, such as double fluid level, colon pulled up by the gastrocolic omentum, spontaneous reduction, etc., are inconstant and not necessary for diagnosis of volvulus.

SYMPTOMATOLOGY

The most commonly mentioned symptoms in these cases are as follows:

1. Intermittent attacks of acute, colicky, upper abdominal pain.
2. Fullness or distention of upper abdomen.
3. Vomiting.
4. A symptom complex suggestive of gastric or duodenal ulcer.
5. Loss of weight.

TREATMENT

Medical. Some cases may respond to medical treatment consisting of tube aspiration of the stomach. Cardon, Greenebaum, and Arendt[5] report a case in which the volvulus was reduced after aspiration of the obstructed and dilated stomach, repeated daily for eight days. Most of these cases will have recurrences, however, and if this occurs surgery is indicated.

Surgical. In addition to the cases showing recurrences, surgery is also indicated in acute cases with complete obstruction and gradually increasing distention.

Bergh[1] advocated partial gastric resection as the treatment of choice. Rose[11] also reports a case which was treated by partial gastrectomy. However, etiological factors found in this case were two bands of adhesions, one from the lesser curvature of the stomach to the anterior abdominal wall and the other from the greater curvature to the colon. The volvulus occurred intermittently around these two fixed points. In the intervals the stomach was dilated due to a marked pyloric stenosis and deformed bulb secondary to an old healed ulcer.

In most cases, however, the surgical treatment indicated is not resection but reduction of the volvulus and correction of any associated pathology. If the stomach is markedly obstructed and distended, trocar aspiration of the gastric contents may be necessary[9,13] before the reduction can be accomplished. If omental or diaphragmatic defects are present they should be closed or repaired. Robnett and Jones[10] report 3 cases which were treated in this manner.

In most cases, especially those that show only elongation of the omenta, an anterior gastropexy is probably also indicated[9,12] in order to prevent recurrences.

REPORT OF CASE

Mrs. L. L., aged forty-nine, was admitted to Ravenswood Hospital on July 24, 1947. She related a history of vomiting, anorexia, and weight loss during a period of three months before admission. The vomiting usually occurred a few hours after meals and occasionally at night. An increasing feeling of fullness appeared especially after the noon meal. She then would become nauseated and, after vomiting, the symptoms were relieved. There was no history of hematemesis or melena and no abdominal distention. At times she noted a sharp epigastric pain just before vomiting. During this three month period she had lost 32 pounds, from 146 to 114.

The physical examination at the time of admission showed no abdominal distention. The only physical finding of any significance was

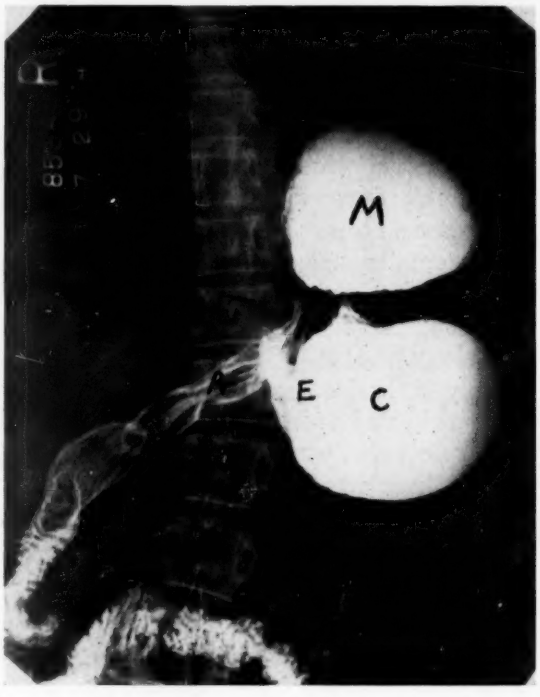

FIG. 1 Roentgenogram immediately following the barium meal on July 29, 1947. The parts identified are *A*, the pars pylorica of the stomach; *E*, the esophageal orifice; *C*, the cardiac portion of the stomach; *M*, the pars media located high under the elevated left diaphragm. The normal mucosal pattern of the pars pylorica, pylorus, and duodenal bulb is clearly seen.

loud bowel sounds just below the xiphoid process.

Roentgen Examination. Roentgen examination of the gastrointestinal tract was started on July 29, 1947. At the time of the roentgenoscopic examination of the stomach, a single fluid level was noted in the stomach before the barium meal. After the patient swallowed barium, the cardiac portion of the stomach was seen to be located below the pars media which was rotated 180 degrees to a position immediately under the left diaphragm. There was an hour glass constriction of the stomach at the junction of the pars media and cardia with a definite spiral configuration of the rugae at this

Fig. 2. Roentgenogram, also at the time of the first barium meal. The spiral appearance of the rugae is demonstrated between the pars media and cardia. The pars media is designated by *M; C* is the cardia of the stomach; *E*, the esophageal orifice; *A*, the pars pylorica; *B*, the duodenal bulb.

point and marked obstruction (Fig. 1). The pars pylorica of the stomach was considerably elongated. The pars pylorica and the bulb were directed downward and to the right with a wide low curve of the second and third parts of the duodenum. There was no evidence of any filling defect in the stomach, pylorus, or duodenal

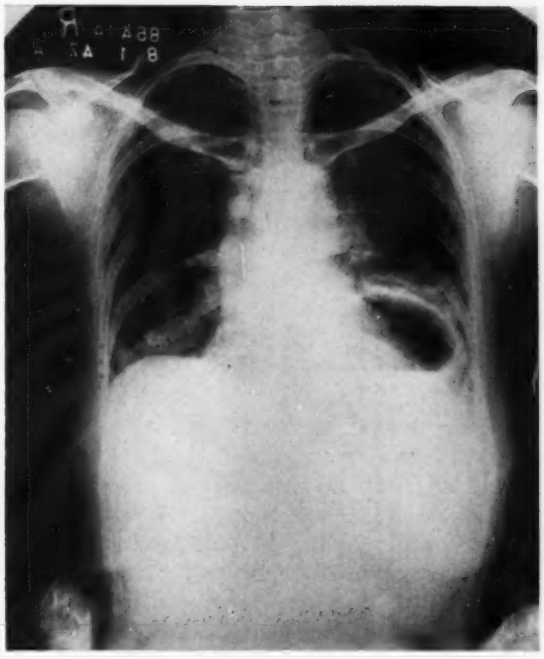

Fig. 3. Roentgenogram of the chest before surgery shows the air-distended pars media of the stomach under the elevated left diaphragm.

bulb. Figure 2 shows the definite spiral appearance of the rugal pattern at the junction of the pars media and cardia. The five hour examination showed a large residue of barium in the stomach and there was still considerable retention of the barium in the stomach at twenty-four and forty-eight hours after the barium meal.

Roentgen examination of the colon revealed a normal colon in normal position, apparently showing no relationship to the volvulus of the stomach.

A roentgenogram of the chest on August 1, 1947 (Fig. 3) showed marked elevation of the left diaphragm which was displaced upward by the air-distended pars media of the stomach. The left lower lung field showed evidence of compression due to the high position of the diaphragm. The changes in the right base were interpreted as being possibly due to bronchiectasis.

Treatment. Surgery was done on August 5, 1947. The stomach was found to be long and unusually movable. The gastrocolic and gastrohepatic omenta were longer than usual, permitting marked rotation and upward displacement of the stomach, which was found to be in a position as indicated by the roentgen ex-

amination. All tissues appeared normal and there was no evidence of any circulatory constriction. The stomach showed no intrinsic pathology. Reduction of the volvulus was easily accomplished and a posterior gastroenterostomy was done in an attempt to hold the stomach in normal position.

The postoperative course was uneventful except for slight, intermittent elevation of temperature and the patient was discharged on August 16, 1947. At this time she was feeling much improved with no vomiting or distress and tolerating a general diet.

Follow-up. The patient returned October 2, 1947, for re-examination. In the two months' interval following surgery she had gained some weight and had only occasional, mild abdominal distress. There had been no vomiting or any recurrence of the previous obstructive symptoms of the stomach. Roentgen examination at this time showed the same position of the stomach as was found before surgery except for slightly less torsion of the pars media. There was also much less gastric retention with only a small residue at five hours. The gastroenterostomy stoma was small and most of the barium was evacuated from the stomach via the pylorus.

The recurrence of the volvulus in this case and the almost identical roentgen appearance two months after surgery suggests that it should be given the further subclassification of "permanent" as suggested by Campbell.[4]

It is possible that a better surgical result may have been obtained in this case with an anterior gastropexy, as discussed previously in this article.

SUMMARY

1. This patient presented typical roentgen and surgical findings of a complete organo-axial volvulus and mesenterio-axial rotation of the stomach, both of 180 degrees.

2. Surgical treatment consisted of reduction of the volvulus and posterior gastroenterostomy.

3. There was recurrence of the volvulus, although the patient's general condition was very much improved.

4. Anterior gastropexy possibly would have given a better surgical result.

5. A brief review of the American and British literature is presented.

6. The pathology, etiology, roentgenological criteria, and treatment of volvulus of the stomach are discussed.

7. The importance of differentiating true volvulus of the stomach from simple rotations and high positions of the stomach is emphasized.

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Vol. 69, No. 1

ROENTGENOGRAPHIC DIAGNOSIS OF TUMORS OF THE GLOMUS JUGULARIS*

By PAUL A. RIEMENSCHNEIDER, M.D., GORDON D. HOOPLE, M.D., DAVID BREWER, M.D., DAVID JONES, M.D., *and* ARTHUR ECKER, M.D.

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TUMORS of the middle ear are relatively rare even in the large clinics. Most of those which have been examined microscopically have been described as sarcomas or have fallen into a heterogeneous group referred to as hemangioendotheliomas, angiomas, endotheliomas, or peritheliomas. Many tumors of this group probably represent tumors of the glomus jugularis.

Guild[1] in 1941 first presented a description of a structure lying in the adventitia of the dome of the jugular bulb immediately below the floor of the middle ear which he named the "glomus jugularis." This organ was in all respects histologically similar to the carotid body and by inference perhaps performs a similar physiologic function.

In 1945 Rosenwasser[7] published a description of a tumor of the carotid body type located in the middle ear and mastoid process with the suggestion that it might have arisen from the glomus jugularis. Reports by LeCompte, Sommers and Lathrop[3,4] and by Kipkie[2] in 1947 describe similar tumors. Winship, Klopp and Jenkins[8] in 1948 reported 2 further cases of their own. They studied sections of all tumors reported in the literature as well as from several unreported and found a total of 11 certain cases of this type of tumor. They discovered 50 cases diagnosed as hemangioendothelioma of the middle ear since Golgi's original description of this entity in 1869. As many as possible of these tumors were reviewed and 13 additional cases were found which probably warranted classification as tumors of the glomus jugularis. Lundgren[5] in 1949 described 4 cases of his own and discussed 9 cases presented by other authors listed under varied histopathological diagnoses.

There has been a lack of emphasis on the roentgenological diagnosis in the case reports as presented heretofore. Much can be added by proper roentgenological interpretation. Two further cases are therefore presented with descriptions of the roentgenological features.

REPORT OF CASES

CASE 1. G.N., a white male, aged twenty-four, was first seen in June, 1948, complaining of a loss of hearing in the right ear for one year, associated with intermittent beating and pulsation. Within eight months of the onset, there was no usable hearing in the right ear. He complained in addition of dizziness, nausea, vomiting, as well as fullness and a pulsating tinnitus in the right ear. Physical examination was normal except for a bulging of the right drum. There was a pulsation of the drum which could be interrupted by pressure on the right carotid artery. A ligation of the external carotid artery and a right radical mastoidectomy was done by Dr. Gordon Hoople. A very vascular tumor mass was found and removed as far as possible. It was impossible because of the bleeding to determine the exact extent of the tumor. The bulk of the mass appeared to be located in the hypotympanum and there seemed to be erosion of a portion of the medial wall of the middle ear. It was felt at operation that because of its location, the tumor very likely had some connection with the jugular bulb. Histopathologically the tumor proved to be of the glomus jugularis type (Fig. 7).

Following operation because of the incomplete removal a course of deep roentgen therapy was given elsewhere with treatment centered over the external auditory meatus to a total of 1,000 r, measured in air. The patient did well temporarily but in January, 1951, he was involved in an automobile accident after which he complained of hoarseness and pain in his neck and occiput. He was not seen until March, 1951, when he was found to have a paralysis of the right vocal cord. From this point on his

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FIG. 1. Case 1. Anteroposterior view of skull. Massive destruction of the more inferior portion of the petrous pyramid with the ridge remaining partially intact.

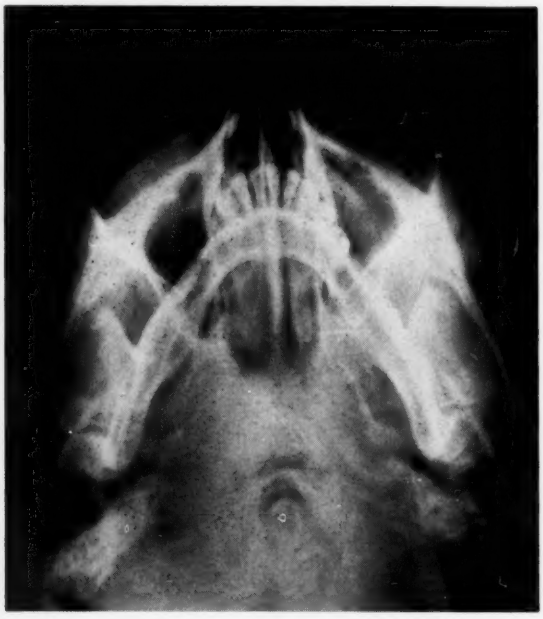

FIG. 2. Case 1. Submentovertical view of the skull. Soft tissue mass projecting into the right side of the nasopharynx with destruction of right side of floor of middle fossa.

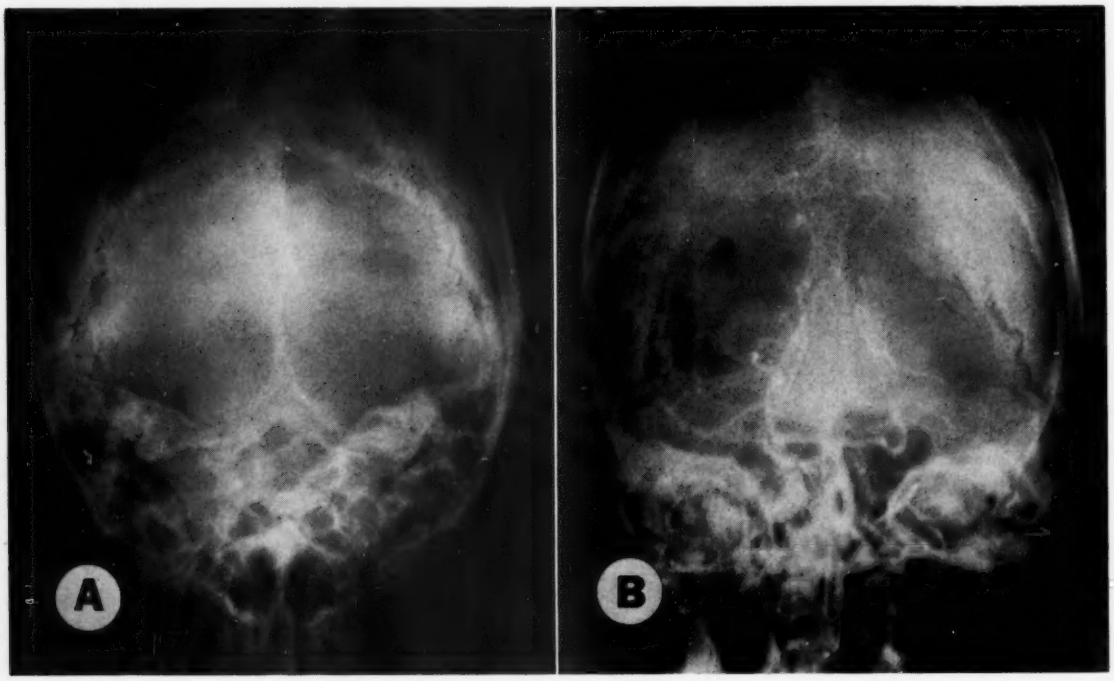

FIG. 3. Case 1. (*A*) Chamberlain-Towne view of the skull. Destruction of petrous pyramid. (*B*) Vertebral arteriogram. Pooling of dye in large vascular spaces. Compare with (*A*).

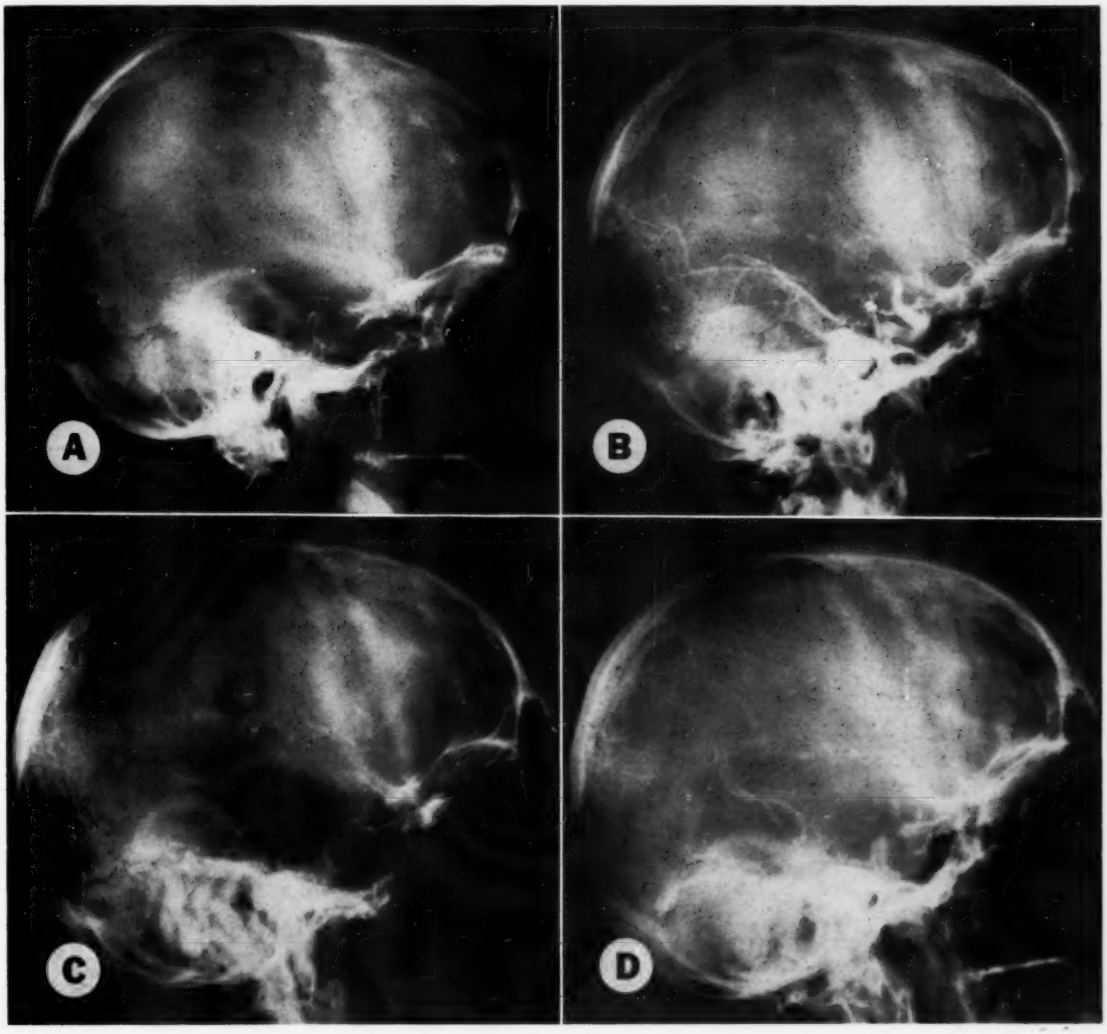

Fig. 4. Case 1. (*A*) Lateral view of the skull. Nasopharyngeal soft tissue mass is vaguely outlined. (*B*) Vertebral arteriogram. Marked distortion of vertebral-basilar system. Extreme upward displacement of posterior cerebral arteries with superior cerebellar arteries above them. Pooling of opaque medium in region of posterior fossa tumor. (*C*) Vertebral venogram. Filling of external carotid branches and increased opacification of posterior fossa. (*D*) Carotid venogram. Marked upward displacement of tentorium demonstrated by displacement of straight sinus.

course was rapidly retrogressive. On admission to the hospital a few days later he had paralysis of the 5th, 7th, 9th, 10th, 11th and 12th cranial nerves on the right side. A bloody polypoid mass presented in the right external auditory canal. He had marked bilateral papilledema and complained of severe headache.

Roentgenograms of the skull demonstrated massive erosion of the petrous pyramid on the right. The destruction appeared to be most marked in its lower portion and the ridge itself seemed intact as a hollow shell (Fig. 1). There was a large soft tissue mass projecting into the right side of the nasopharynx (Fig. 2). Vertebral angiograms done by the indirect method demonstrated marked pooling of diodrast in an extremely vascular tumor mass occupying the region of the destroyed petrous pyramid as well as a marked distortion of the basilar artery and upward displacement of the posterior cerebral arteries. The most marked vascularization was evident on a venogram which shows also some filling of the external carotid artery suggesting that part of the vascular supply of the tumor may be from this source. It is interesting that the lateral arteriogram shows the superior

FIG. 5. Case II. Chamberlain-Towne view of skull. Extreme destruction of inferior portion of petrous pyramid. Note small vascular channels in right occipital bone.

cerebellar artery at a higher level than the posterior cerebral suggesting the possibility of upward herniation of the cerebellum through the tentorium (Fig. 3 and 4). In the hope of relieving the patient's papilledema as well as his severe headache, a posterior temporal craniotomy was done by Dr. Arthur Ecker with a subtemporal approach to split the tentorium and provide a partial decompression. Following surgery the papilledema disappeared. This procedure is being followed by a course of deep roentgen therapy.

CASE II. M.B., a white female, aged fifty-two, had a tumor removed from the right middle ear in 1922 at the age of thirty. A similar tumor was again removed one year later. From 1923 to 1927, intermittent drainage had continued. In 1927 a right radical mastoidectomy was done with incomplete removal of the tumor. In 1930 a second mastoidectomy was done following which the patient had a permanent right facial paralysis. In December, 1948, she began to have bleeding from the right ear along with some thin purulent material. When first seen by one of us in February, 1949, there was a large swelling completely surrounding the lower two-thirds of the right auricle and extending down into the neck. This was pulsating and had a palpable thrill. There was a polypoid mass extending from the right external meatus which bled easily, a section of which was removed for biopsy. Histopathological study was consistent with a diagnosis of tumor of the glomus jugularis (Fig. 8).

Roentgenograms of the skull showed an extensive destruction of the petrous pyramid on the right side, apparently associated with a mass projecting into the right side of the nasopharynx. This destruction was again most marked in the lower portion of the pyramid and there appeared to be numerous abnormal small vascular channels in the occipital bone just behind this area (Fig. 5 and 6). At operation there was found a tremendous right jugular vein some 3 to 4 centimeters in diameter. The right internal carotid had been ligated at one of the previous operations. The right external carotid was ligated by Dr. Gordon Hoople. Following operation the bleeding mass persisted. One hundred milligrams of radium were inserted into the ear for ten hours. Nine months later the ear was almost dry and there was a marked decrease in swelling of the tissue.

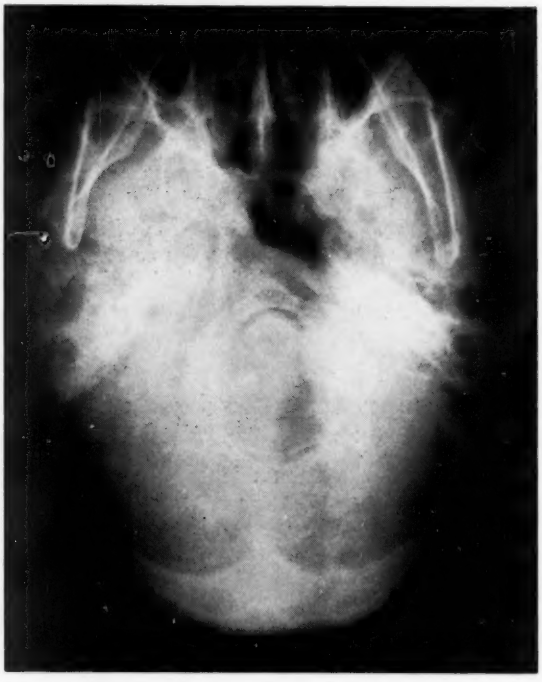

FIG. 6. Case II. Submentovertical view. Mass projecting into right side of nasopharynx. Destruction of right side of floor of middle fossa.

DISCUSSION

The reported cases of tumor of the glomus jugularis seem to fall into two general groups, the benign and the malignant. It is not clear whether the benign tumors represent an earlier stage of the malignant variety. The tumor arising in the adventitia above the dome of the jugular bulb would seem to rapidly erode through the floor of the middle ear, filling it and eventually breaking through the tympanic membrane to present as a bleeding mass in the external canal. With the malignant change, there is massive destruction of the petrous pyramid, involvement of the cranial nerves, pressure on the brain stem, and a mass in the nasopharynx.

Winship, Klopp and Jenkins[8] have called attention to the remarkable clinical similarity in all the reported cases. They tend to have a prolonged history and the patients frequently first present themselves because of a recurring bloody aural polyp. Loss of hearing, otorrhea, facial paralysis and pain are other frequent complaints, with involvement of other cranial nerves occurring late in the course of the disease.

The microscopic appearance of all the tumors fits a characteristic pattern with sheets of plump epithelial cells separated into alveolar groups by a delicate, highly vascular stroma. The cells show a rather marked variation in shape and size. Mitotic figures are rare even in the more malignant tumors, as is also true with tumors of the carotid body. The cytoplasm is slightly granular and eosinophilic. The nuclei tend to be spherical, and large, bizarre forms are occasionally seen. The stroma is extremely vascular and contains many small blood vessels and other spaces lined by endothelial cells.

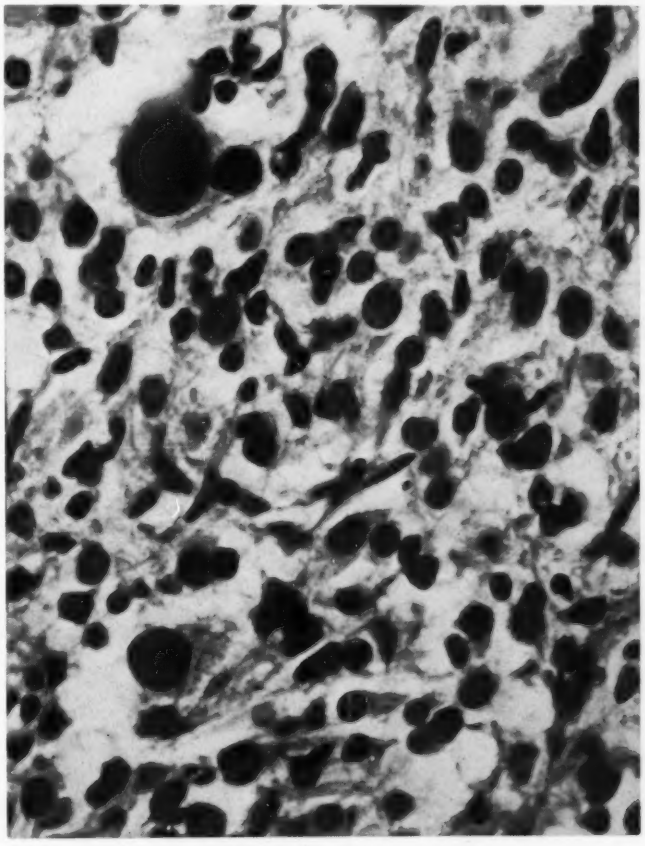

FIG. 7. Case 1. Photomicrograph of tumor (×720).

In the reports where descriptions of the roentgenograms are given for the more benign tumors, they are described as showing a sclerosis of the mastoid consistent with a chronic mastoiditis. Where descriptions are given in the literature of more advanced tumors, a massive destruction of the petrous pyramid is always mentioned.

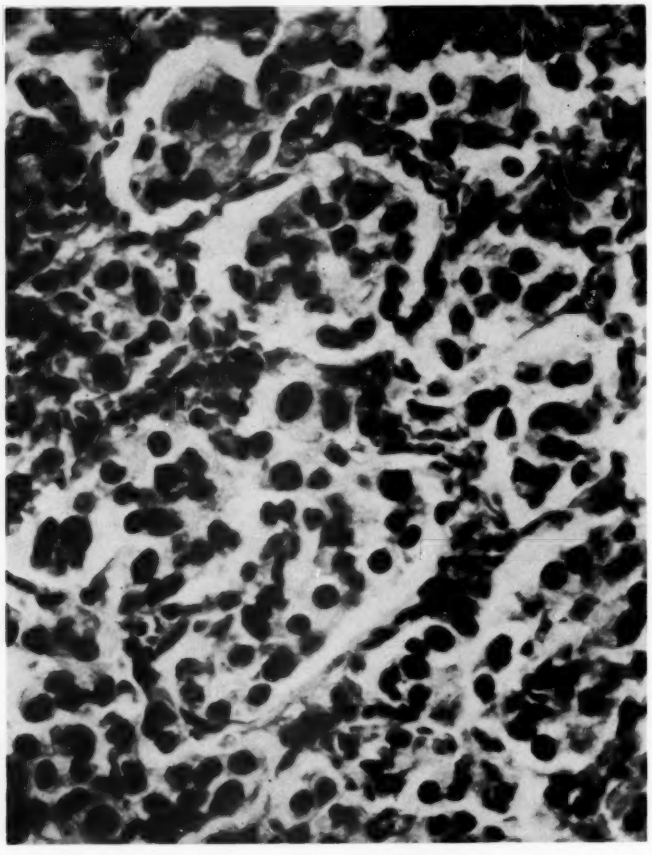

FIG. 8. Case II. Photomicrograph of tumor (×720).

Both of the cases reported here show this destruction as the outstanding feature. The loss of bone seems to be most marked in the lower portion of the pyramid with the ridge remaining as a more or less intact shell. In addition, both of these cases demonstrated a mass in the posterior nasopharynx. A vertebral angiogram in one case showed a marked abnormal vascularization in the region of the destroyed petrous pyramid. The opaque medium was seen to pool in large abnormal channels. It is of interest that the best visualization of the tumor was seen in a venogram, which also showed fair filling of branches of the external carotid artery. It is known that the normal vascular supply of the glomus jugularis arises from the external carotid artery. It is possible that the blood supply of the tumor early is from this source and later also from the vertebral-basilar arterial system. In addition, there was seen the extreme upward displacement of the tentorium and the marked distortion of the basilar and posterior cerebral arteries. A case operated on by Poppen[6] had vertebral angiograms which also demonstrated the remarkable pooling of contrast medium in the tumor mass.

The differential diagnosis of these tumors from a roentgenographic viewpoint is interesting. In the early stage, it is probably true that no differentiation can be made from a chronically infected mastoid.

When destruction of the petrous pyramid and the soft tissue mass have appeared, the roentgenograms assume more importance in relationship to the clinical history. Undoubtedly, the most common tumor resulting in changes in the petrous bone is the acoustic neurinoma. Here, ordinarily, there is more evidence of erosion and widening of the internal meatus and less emphasis on the massive destruction of the lower portion of the pyramid. The soft tissue mass in the nasopharynx also affords a clue. The various tumors of the nasopharynx frequently present as such masses visible roentgenographically together with erosion of the floor of the skull. The massive destruction of the entire petrous pyramid would be unusual for these tumors. The chordomas will frequently be marked by some aberration of the dorsum sellae in addition to the other bone and soft tissue changes. Carcinoma of the sphenoid sinus will show its primary destruction locally. Metastatic carcinoma may, of course, present almost any picture. However, none of these tumors should produce the tremendous vascularity visible in the angiograms of glomus tumors. These observations associated with the changes visible in plain roentgenograms of the skull should make the diagnosis almost certain.

The relatively recent recognition of tumors of the glomus jugularis as a distinct entity behooves each physician involved in the care of the patient to recognize its occurrence. The extreme vascularity of the tumor makes adequate biopsy difficult, but the typical clinical history and roentgenographic findings should make a tentative diagnosis possible. A recurring bloody polyp in the external canal and the roentgenographic picture of chronic sclerosed mastoiditis are presumptive diagnostic findings. If the tumor is localized to the middle and external ear, radical resection and cure should be possible in a fair proportion of cases. Destruction of the petrous pyramid or a soft tissue mass in the posterior nasopharynx probably indicates inoperability. Vertebral angiography will demonstrate the tremendous vascularity of the tumor and the distortion of normal vessels as a result of the tumor mass.

There is little evidence in the literature that radiation therapy of tumors of either the carotid body or of the glomus jugularis accomplishes any considerable improvement. However, the few reports of fair results suggest that irradiation is worth trying in cases of obvious inoperability.

SUMMARY

1. Two cases of tumor of the glomus jugularis are reported emphasizing the roentgenographic findings.

2. Roentgenograms of the skull at first show an appearance of chronic sclerosing mastoiditis. Later there is massive destruction of the petrous pyramid, with or without a mass in the posterior nasopharynx. This destruction is most marked in the lower portion of the pyramid with the ridge left as a shell above.

3. Vertebral angiograms demonstrate the tremendous vascularity of the tumor and the displacement of normal structures as a result of the space occupying lesion.

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HEMANGIOMA OF THE MEDIASTINUM*

CASE REPORT

By JAMES M. KEEGAN, CAPTAIN, USAF (MC)

NEOPLASMS of vascular origin in the mediastinum are rare. Standard textbooks of pathology and thoracic surgery do not mention primary hemangioma in their sections on mediastinal tumors. Neither Heuer and Andrus[4] in their monograph, *Surgery of Mediastinal Tumors*, nor Bradford *et al.*[3] in their extensive classification of these tumors mention this entity. Bergstrom[2] reported 2 instances in which mediastinal hemangiomas caused death in newborns. He felt that this type of tumor would be encountered more frequently if autopsies were routinely employed following death in newborns. Adams and Bloch[1] described a mediastinal hemangioma which was grossly invasive. Seybold *et al.*[5] after an extensive review of the literature, found 14 cases of mediastinal tumor of vascular origin. These included endotheliomas, angiosarcomas and hemangioendotheliomas, as well as cavernous hemangiomas. They added 3 cases. Of this total of 17 cases, 6 were listed as hemangiomas. Recently, Thomas and Chesser[6] described the findings in a patient whose cavernous hemangioma was surgically removed. Thus, to date 18 mediastinal tumors of vascular origin have been described. Of these, 7 were hemangiomas. To this number may be added the following case report.

REPORT OF CASE

An eighteen year old white female cashier (N.Y.H. No. 603773) was seen by her physician because of complaints of nonradiating epigastric pain associated with anorexia, nausea and occasional vomiting. There had been a 7 pound weight loss during the preceding month.

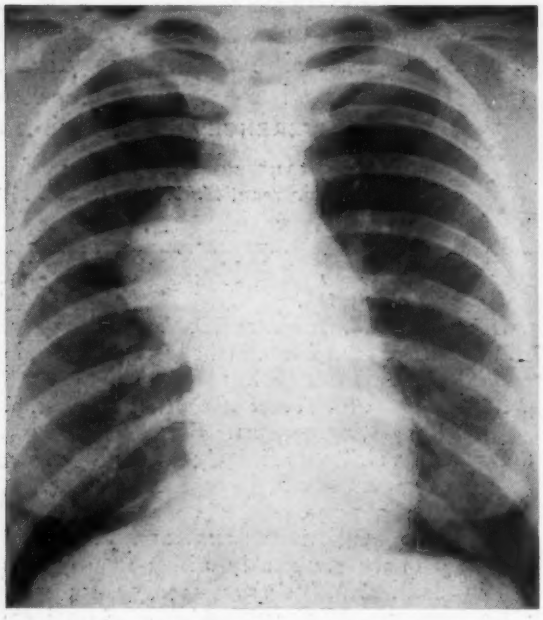

FIG. 1. Posteroanterior projection showing a large rounded mass near right hilus.

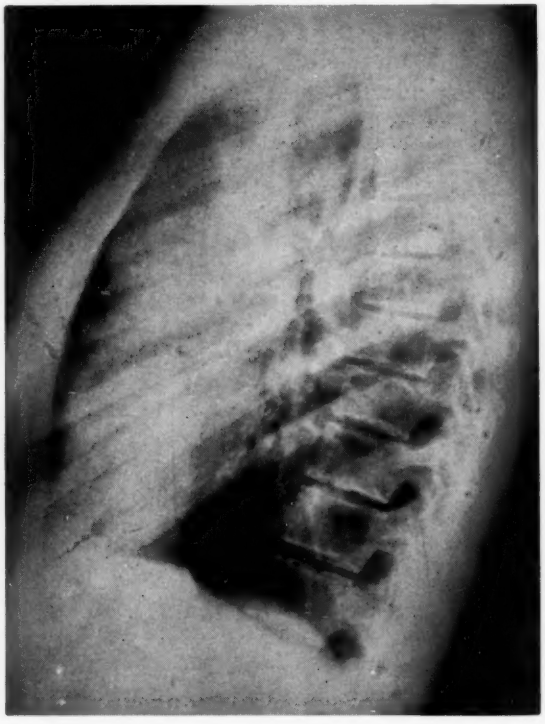

FIG. 2. Lateral film showing the tumor to be situated in anterior mediastinum above the heart.

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Chest roentgenoscopy showed a large, oval, right hilar mediastinal mass. The patient was referred to the New York Hospital for further diagnosis and treatment.

History revealed no symptoms related to the vascular or respiratory systems. Physical examination was noncontributory. Laboratory studies including urinalysis, hemogram, Wassermann test, blood chemistry, bone marrow examination and gastrointestinal series were not remarkable. There was no evidence of pressure defect or displacement of the barium-filled esophagus. Bronchoscopy and gallbladder series showed no abnormality. Chest roentgenograms (Fig. 1 and 2) revealed an anterior mediastinal mass extending into the right hilar area. Kymography showed that the tumor did not pulsate. Laminagraphy (Fig. 3) revealed a homogeneous, discrete, round, soft tissue mass measuring 8.5 by 7 cm. and a separate smaller mass just below the body of the tumor. Angiocardiography (Fig. 4 and 5), done previously at another hospital, showed that the mass produced a pressure defect on the superior vena cava and displaced this vessel posteriorly. No opacification of the tumor was noted.

Fig. 3. Frontal laminagram shows solid tumor mass as well as a small extension along the right border of the heart.

Thoracotomy was performed on July 16, 1951. The lung was uninvolved. In the anterior mediastinum on the right side there was a grayish, somewhat cystic mass about 7 by 8 by 8 cm. in size. This had a tendency to bleed easily. Below and continuous with the body of

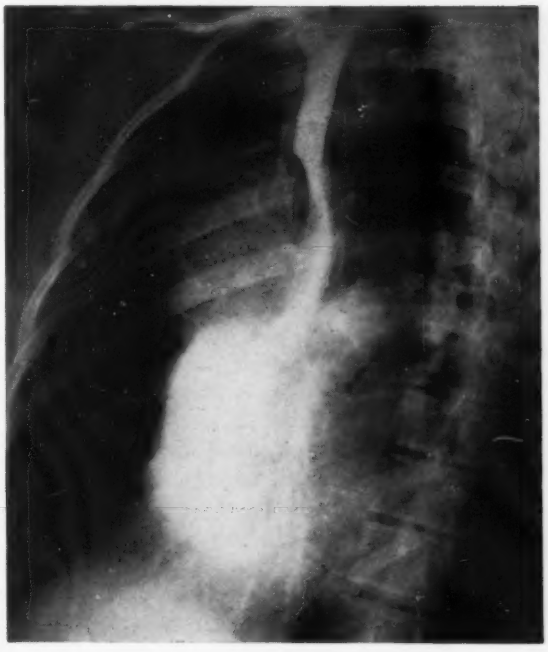

Fig. 4. Left anterior oblique angiocardiogram shows compression of the superior vena cava and its displacement posteriorly by the tumor mass.

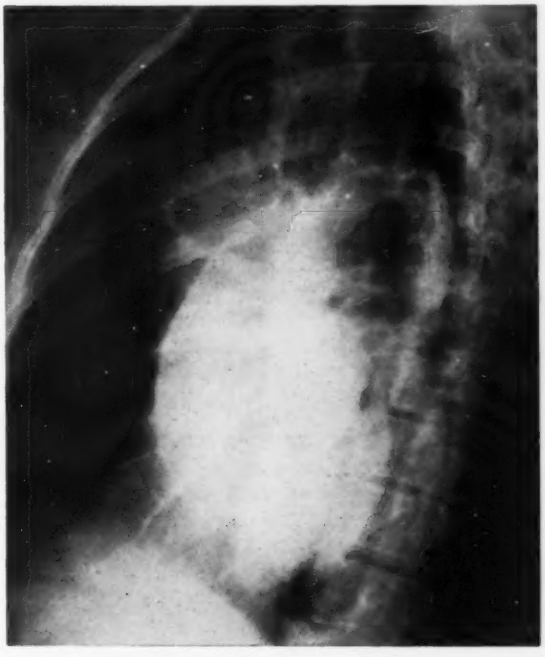

Fig. 5. Left anterior oblique angiocardiogram with left ventricle and aorta opacified. No contrast substance is seen within the tumor.

the tumor there was a nodular extension which was the smaller tumor seen on the laminagrams. In one area, the mass appeared to invade the right side of the heart. Extensions into the left hilar as well as subdiaphragmatic areas were present. Since it was felt that the lesion was inoperable, the chest was closed after two portions of the mass were removed for pathological study.

Histopathological examination revealed numerous large and small endothelial lined vascular spaces lying in loose fibrous stroma. The lumina were sometimes empty and sometimes filled with blood. Many were filled with organized thrombi. A lymph node adjacent to the tumor showed that the greater portion of its parenchyma was involved by tumor. No histopathological evidence of malignant change was noted. Only well differentiated endothelial cells were evident. The pathological diagnosis was hemangioma of the mediastinum with benign characteristics histopathologically, but gross and microscopic evidence of invasiveness.

The follow-up in this case is seven months; the patient remains asymptomatic. Radiation therapy given elsewhere has had no effect on the size of the lesion to date.

Comment. Nothing in the history, physical or laboratory studies suggested the type or invasive nature of the lesion. Angiocardiography did not aid in making a definite diagnosis since insufficient opacity within the tumor was achieved. Her age and asymptomatic course parallels that of the patient reported by Thomas and Chesser.[6] They, however, found a benign lesion at operation. Seybold *et al.* used as criteria of malignancy: histopathological appearance, metastasis or invasiveness. In the 17 vascular mediastinal tumors which they reported, only one lesion failed to show one or more of the above. Insufficient data left 3 unclassified. The present lesion is similar to most mediastinal hemangiomas in that it is malignant according to these standards.

The present case is reported because of the rarity of this type of tumor in the mediastinum and because of the pathological paradox of a histopathologically benign lesion which was grossly invasive.*

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* The angiocardiograms shown in Figures 4 and 5 were made available through the courtesy of Dr. Henry K. Taylor, Radiologist to the Goldwater Memorial Hospital, New York.

Vol. 69, No. 1

A SACCULAR OUTPOUCHING OF THE RIGHT VENTRICLE IN A CHILD VISUALIZED BY ANGIOCARDIOGRAPHY*

By G. MILLER, M. LOWENTHAL, S. KRAUSE, *and* P. ROSENBLUM

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ALTHOUGH numerous cases have been reported demonstrating a diverticulum of the membranous septum of the heart,[8,10] the finding of a small localized, saccular outpouching of the ventricular myocardium is rare, particularly in children. The following case is presented to demonstrate some interesting angiocardiograms of a possible saccular aneurysm or diverticulum of the right ventricle in a child.

CASE REPORT

A boy, aged twelve, was admitted to the hospital on April 5, 1950, for a check-up because an abnormal cardiac configuration had been noted on a routine roentgenogram taken six months previously.

Birth, growth and development had been normal. No episodes of dyspnea or cyanosis were ever observed and the only childhood illnesses which he had were measles and mumps. There are three other children in the family (two girls and one boy), none of whom presents any history or evidence suggesting cardiac disease or any congenital anomaly.

On physical examination, he was a well developed, slightly obese white male, appearing in good health. No abnormalities were noted except for the cardiac examination. The point of maximal impulse was in the fifth intercostal space just outside the mid-clavicular line. Regular sinus rhythm at a rate of 88 per minute was present. A faint, grade one apical systolic murmur could be heard both at rest and with exercise. The second pulmonic sound was not accentuated, but was slightly louder than the aortic second sound.

Laboratory findings: Red blood cell count, 4.83 million; white blood cell count, 7,200, with a normal differential count; hemoglobin, 15.1 grams; ether circulation time, 4 seconds; decholin (arm to tongue) circulation time, 13.5 seconds; Wassermann reaction, negative; tuberculin test 1:1,000, negative. The electrocardiogram (Fig. 1) shows regular sinus rhythm and right heart strain.

On roentgenoscopy, there was distinct enlargement of the heart to the right and left in the posteroanterior view, with slight enlargement of the left ventricular outflow tract. Tenting of the pericardium could be seen (Fig. 2). In the oblique views, moderate enlargement of the right ventricular inflow and outflow tracts could be seen. The right auricular appendage was elongated, but the left auricle appeared normal.

Cardiac catheterization was performed on March 5, 1951. The pressures in the main pulmonary artery (28/1 mm. Hg), right ventricle (26/4 mm. Hg) and right auricle (7/1 mm. Hg) were all normal, and oxygen analysis of the blood samples taken failed to reveal any abnormal cardiovascular communications.

An angiocardiogram was made in the right posterior oblique position. The opaque medium was seen to fill the superior vena cava and right auricle (Fig. 4) and then the right side of the heart and pulmonary arteries (Fig. 5 and 6). With the filling of the right ventricle, a region the size of a quarter at the apex of the right ventricle filled with opaque medium and this area was seen to be connected to the main body of the medium by a small, string-like communication. With the emptying of the right ventricle, this little area also emptied. In later angiocardiograms, the left side of the heart also filled, but because of a seizure of coughing, good visualization of the left side of the heart was not obtained.

Re-examination one year later, including electrocardiogram and cardiac roentgenoscopy, showed no change from the earlier cardiac findings.

DISCUSSION

In reviewing the angiocardiograms on

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This department is supported in part by the Michael Reese Research Foundation. Aided by a grant from the National Heart Institute (H218C).

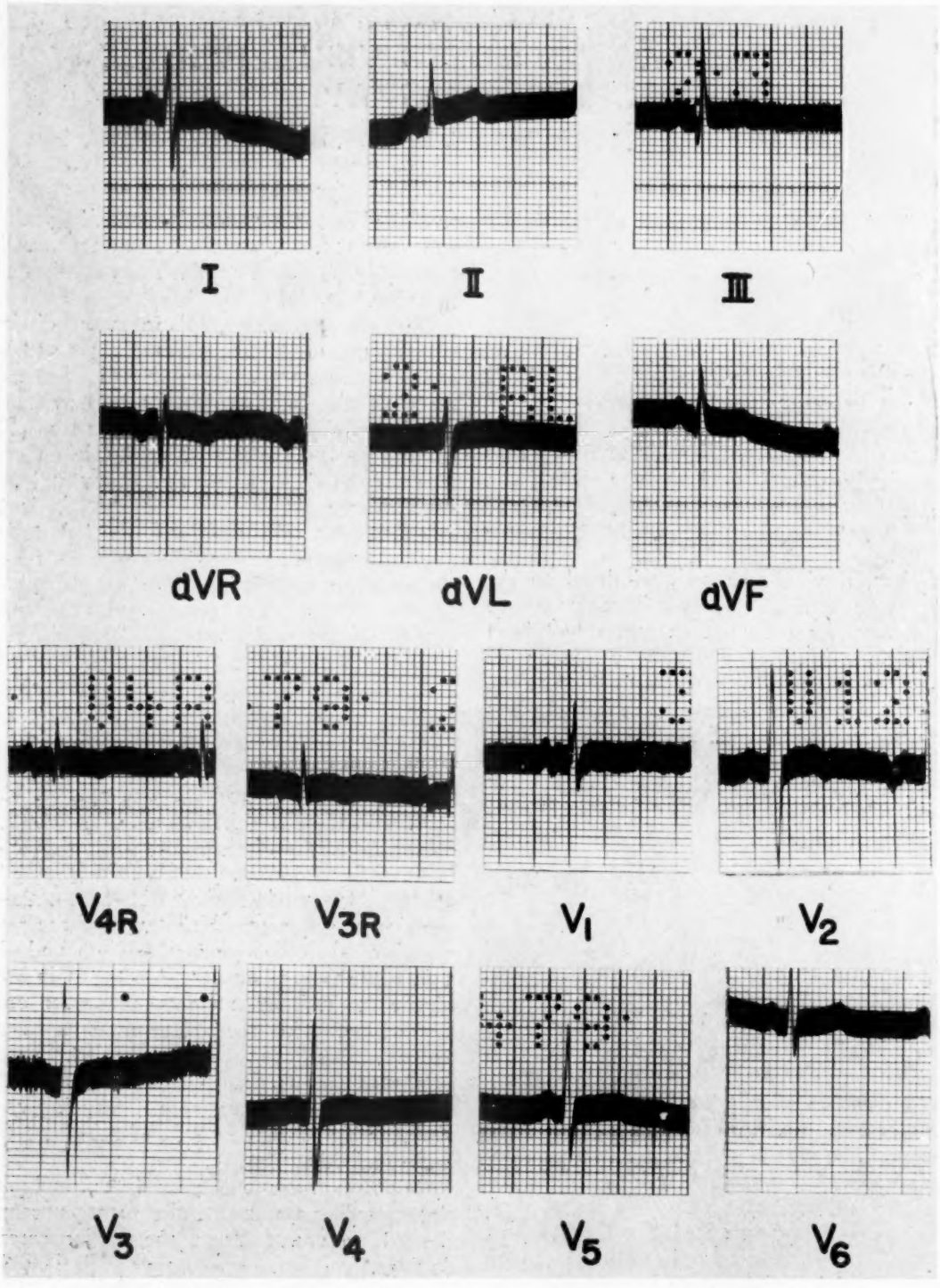

FIG. 1. Electrocardiogram. Note regular sinus rhythm and right heart strain.

this patient, several diagnostic possibilities were considered. The idea that a large moderator band in the right ventricle might isolate a pocket of diodrast was entertained. This seems to be ruled out by the fact that the localized collection

of opaque medium projects beyond the expected contour of the right ventricle. If the pocketing were produced by a large moderator band, the outer border of this pocket should fall within and not outside the expected cardiac border.

Could this be a congenital diverticulum of the right ventricle? Abbott,[1] in 1915, reported 2 cases of congenital diverticulum of the left ventricle. Additional cases of diverticulum of the heart have appeared,[11,14] but none has been observed in the right ventricle.

Fig. 2. Posteroanterior roentgenogram. Note generalized cardiac enlargement to the right and left as well as pericardial adhesions at the right cardiac border.

The possibility also exists that this might be a small saccular aneurysm. Several possible etiologies of acquired saccular aneurysms of the heart have been reported. They may occur in areas of the myocardium weakened by infarction[6,12] and such cases have been reported in children in whom an aberrant coronary artery arose from the pulmonary artery.[2,13] There is no evidence for an aberrant source of a coronary artery in this patient. Other conditions which have been considered as occasionally etiologically responsible for the development of ventricular saccular aneurysms are myocarditis, myocardial trauma, myocardial abscess, syphilitic gumma, and tuberculous granuloma of the myocardium.[3,4,5,7] This child presents no history of cardiac trauma and both the Wassermann and tuberculin tests were negative. Macfie and Ingram[9]

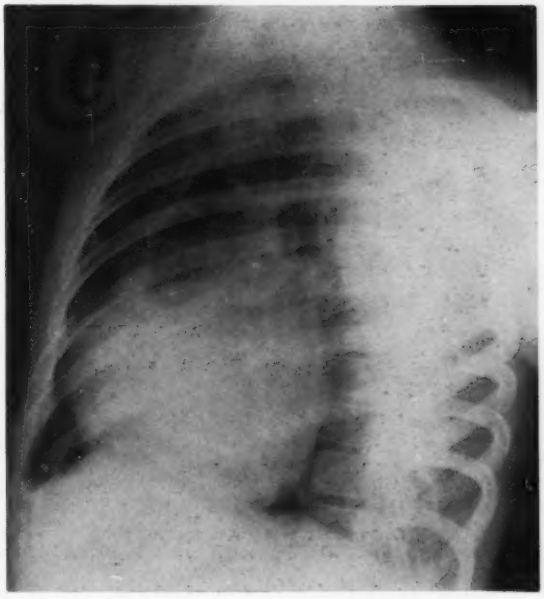

Fig. 3. Left oblique roentgenogram taken prior to the injection of diodrast.

Fig. 4. Angiocardiogram with opaque medium filling the superior vena cava and right auricle and entering into the right ventricle.

FIG. 5. Later angiocardiogram with diodrast now in the right ventricle and pulmonary arteries. Note the small saccular outpocket of the right ventricle filled with diodrast.

FIG. 6. Still later angiocardiogram with the right ventricle and its outpouching partially emptied of the opaque medium.

reported 3 interesting cases of left ventricular aneurysm in young boys of West Africa in whom the authors considered a malarial endarteritis as responsible for the myocardial degeneration leading to the aneurysm formation. There is nothing that suggests such an occurrence in this case. Although the child presents no history of a myocarditis (rheumatic or virus), it is possible that he may have suffered such an illness in the past and could have had a localized area of weakened myocardium leading to the development of an aneurysm. An old myocarditis could also be invoked to explain the cardiomegaly.

It is apparent that one cannot, on clinical grounds, make a definite diagnosis of either a congenital diverticulum or an acquired saccular aneurysm of the right ventricle. Nevertheless, the angiocardiograms are sufficiently unusual to warrant placing them on record.

SUMMARY

A case is reported in which, in a twelve year old boy, angiocardiographic visualization of a small saccular outpouching from the right ventricle was observed. This outpouching is thought to be either a congenital diverticulum or a small, acquired saccular aneurysm of the right ventricle.

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UTEROSALPINGOGRAPHY*

WITH SPECIAL REFERENCE TO THE CERVICAL CANAL

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VISUALIZATION of the cervical canal, uterine cavity and tubes by uterosalpingography is a useful adjunct in diagnosing lesions of the female genital tract. The cervical canal is often obscured during uterosalpingography by the technique used, and in so doing at least half the value of the examination is lost.[3]

TECHNIQUE

The following instruments are prepared on a sterile tray:

Jarcho cannula (the large curve present when the cannula is new is straightened and a small curve bent in the last inch)
Tenaculum
Speculum
Sponge forceps
Sponges
10 cc. Luer-Lok syringe
Two sizes of rubber acorns for the Jarcho cannula
Medicine glasses

The patient is draped for examination on the roentgenoscopic table. The syringe is filled with iodochlorol and the Jarcho cannula injected until the opaque oil drips from the end, eliminating air bubbles. After a pelvic examination, the speculum is inserted and the cervix is carefully sponged with merthiolate. The cervix is seized across the top by the tenaculum and traction applied to be sure of a secure grasp. The rubber acorn is placed $\frac{1}{4}$ inch from the tip of the Jarcho cannula (the large curve having been straightened), which is then inserted into the cervical canal. The acorn seals the external os by pressure on the cannula and traction on the tenaculum. This is maintained throughout the examination to prevent leakage and both are pulled downward to straighten the cervical canal. The speculum is removed from the vagina and allowed to rest on the cannula and tenaculum. The patient is shifted toward the head of the table and her legs extended. Under roentgenoscopic control, the iodochlorol is injected and serial films made as the cervical canal, uterine cavity and tubes fill. The total amount of opaque oil injected is recorded with each film. During the roentgenoscopic examination the cannula and tenaculum are moved to observe the mobility of the uterus and tubes. Following the examination, the cannula and tenaculum are removed and the patient allowed to lie on the roentgenoscopic table until the films are developed. A twenty-four hour study is made and if oil is present either in the pelvis, uterus or tubes a second film is made seven days later. These last two films are an essential part of the examination and are an important aid in demonstrating patency of the tubes, hydrosalpinx, tubo-ovarian cavities, etc.

DISCUSSION

The best time for the examination is seven to fourteen days after the last day of the menstrual period because the uterine mucosa has sufficiently regenerated to cover the venous channels. Menorrhagia is a contraindication but bleeding from tumor is not necessarily one, if accurate localization and extent of the neoplasm is to be determined. Other contraindications are pregnancy and evidence of a pelvic inflammatory disease. However, there are reported many examinations during pregnancy without its interruption.[5,7]

The ease and accuracy of filling by visual control under the roentgenoscope removes the danger of excess pressure. The uterus

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can be filled and a constant pressure of opaque oil maintained for several minutes. If there is spasm of the cornual sphincters incited by the distention of the uterine cavity, it will relax at some stage of the examination allowing the opaque oil to pass. This is especially true if an antispasmodic has been administered immediately before the examination.

In our series of more than 300 cases the capacity of the cervical canal, uterus and tubes varied from 0.5 to 32.0 cc. No correla-

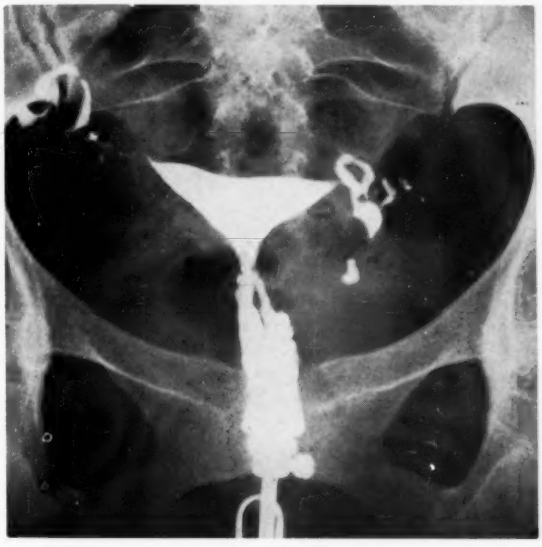

Fig. 1. Longitudinal striations of the cervical canal. No disease. (Reproduced by permission of Paul B. Hoeber, Inc., publishers, from *Fertility and Sterility*, Jan., 1951, *2*, 53–60.)

tion was possible between the roentgen appearance of the cervical canal and the external appearance of the cervix. Polyposis (Fig. 4), stenosis and endocervicitis, could be present with a normal appearing external os and cervix. Two kinds of thickening of the internal os have been demonstrated in the course of our study. One was longitudinal striations due to hyperplasia of the longitudinal ridges and the plica palmatae[2,6] (Fig. 1). The other was polypoid thickening and was much more frequent. This last was due to polyposis and/or endocervical cysts (Fig. 2).

Stenosis of the cervical canal (Fig. 3) and

Fig. 2. Polypoid thickening of the internal os. Probable hypertrophy of the plica palmatae on the left.

internal os may be sometimes symptomless and a definite cause of sterility. It may easily prevent the filling of the uterus and tubes unless the cervical canal is straightened by traction at the time of the examination.

Endocervicitis (Fig. 4, 5 and 6) has been described as a "peculiar feathery or striated appearance as a result of dilatation of the cervical (Nabothian) glands, or to ulceration of the endocervix, or both."[7] However, others[4] have described the in-

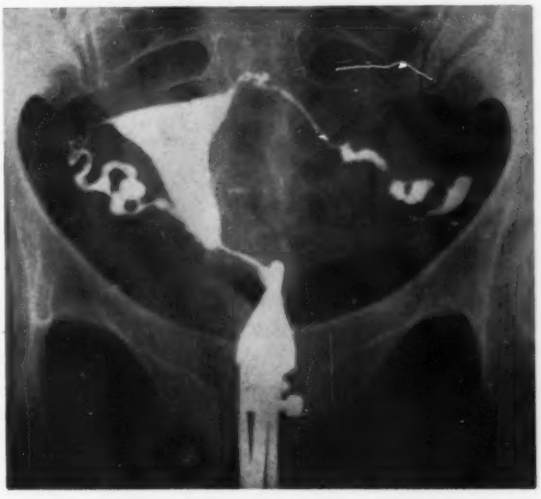

Fig. 3. Stenosis of the cervical canal and internal os.

FIG. 4. Dilated endocervical glands most likely due to endocervicitis. Endometrial polyp just above internal os.

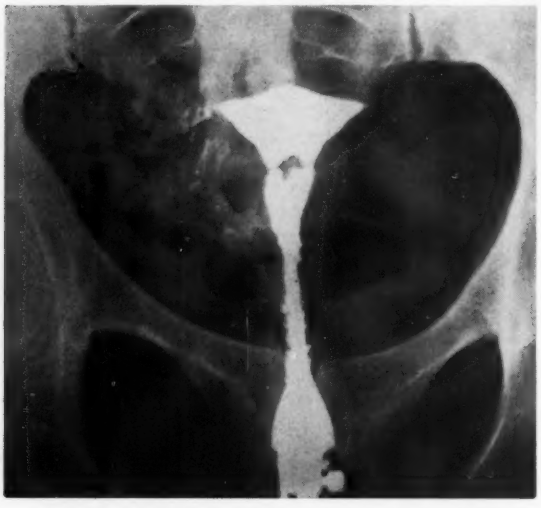

FIG. 5. Endocervicitis. Endometrial polyp.

dented contour of the cervical canal as being well marked plica palmatae. Undoubtedly this is true in some cases, for the thickness of these ridges varies in different subjects (Fig. 6), and it is known that hyperplasia sometimes occurs to such an extent that actual obstruction takes place, particularly at the time of premenstrual congestion.

We believe that the hyperplasia of the plica palmatae can be differentiated from an endocervicitis by the irregularity and the roughness of the cervical canal in the latter.

In our experience iodochlorol has proved a most reliable, stable compound. Because of its chemical stability it is less likely to produce the reactions attributed to opaque oil in the past[1] and has been described as

FIG. 6. Hypertrophied plica palmatae and dilated endocervical glands. Polypoid thickening of the internal os.

the most reliable of oily media.[8] In making examinations again six months or more after the first examination on patients with patent tubes, a survey roentgenogram shows no trace of iodochlorol in the pelvis. If the tubes were obstructed and hydrosalpinx or tubo-ovarian cavities were present, the opaque oil still remained in these cavities and dilatations.

SUMMARY

Roentgen visualization of the cervical canal requires a proper technique of uterosalpingography.

It should be used more often to aid in the diagnosis of lesions of the endocervix and internal os because there is no correlation between the external appearance of the cervix and its internal appearance as seen roentgenologically.

The following points should be observed:

(1) Use of a short-tipped cannula, the end of which protrudes not more than $\frac{1}{4}$ inch beyond the rubber acorn.
(2) Traction on the cervix to straighten the canal.
(3) Removal of the speculum before beginning the injection.

Polyposis, stenosis and scarring, and endocervicitis are easily demonstrated by this method.

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NEWER RADIOPAQUE MEDIA FOR ORAL CHOLECYSTOGRAPHY

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SINCE the introduction of cholecystography by Graham and Cole in 1923 there has been a gradual improvement and simplification of this valuable diagnostic test of gallbladder function. In the early years, most of the effort was concentrated on perfecting the intravenous administration of the chemical and on developing a satisfactory technique for the oral administration of the contrast media. In recent years considerable research has been conducted by the pharmaceutical companies to develop more satisfactory chemical compounds for the oral method. They have been eminently successful, particularly in 1941 with the introduction of iodoalphionic acid, a diiodophenyl propionic acid compound called priodax*,[5] which for the first time provided a medium that rarely caused any unfavorable reaction in the patient, that was packaged in tablets of convenient size for swallowing and that avoided complicated medication and dietary regulation prior to and after their ingestion. Since 1944 a cyclohexane carboxylic acid compound (monophen†)[2,3] has been available for general use and, while it is a satisfactory medium, it is still in the process of being evaluated by the medical profession. In 1951 the latest product, a triiodophenyl propanoic acid compound (telepaque‡)[7] was offered to a limited group for investigation and trial for oral cholecystography. The purpose of this discussion is to describe briefly our experiences with these new cholecystographic media and particularly our results with the use of the ethyl propanoic acid medium.

These three compounds have the benzene ring in common but differ rather widely in the construction of their side chains. The structural formula of each is reproduced in Figure 1 for a comparative analysis. Iodoalphionic acid* (priodax) is a white to faintly yellowish powder containing 51.5 per cent by weight of firmly bound iodine. It is a synthesized acid and is not derived from phenolphthalein. After ingestion and passage through the stomach, it dissolves in the alkaline contents of the small intestine and is then rapidly absorbed into the portal circulation. After concentration in the gallbladder, the gallbladder contents pass intermittently through the common duct into the duodenum and small intestine where reabsorption takes place. Smaller and smaller amounts of the chemical reach the gallbladder while increasingly larger quantities are excreted through the kidneys, so that about 50 per cent appears in the urine during the first twenty-four hours after ingestion and, for the most part, is excreted chemically unchanged. Due to the rapid intestinal absorption and the urinary elimination, there is little tendency for the unabsorbed medium to accumulate in the colon. The iodoalphionic acid molecule is supposed to be held in firm combination with little danger of dissociation and consequent iodism. It is a stable compound and undergoes very little or no deterioration with age. It is supplied in paper containers of six tablets of 0.5 gram each for a total dose of 3.0 grams. In routine oral cholecystography all six tablets are taken at intervals of about five minutes during the ingestion of the evening meal prior to the day of the examination. The size of the tablets is not objectionable to the patient and the directions in regard to foods and meals are easily followed.

* Schering Corporation, Bloomfield, New Jersey.

† National Synthetics, Inc., 270 Lafayette St., New York 12, New York.

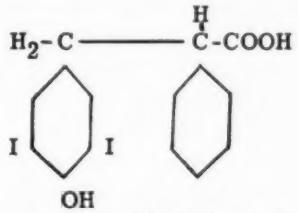
‡ Winthrop-Stearns, Inc., 170 Varick Street, New York 13, New York. The Telepaque for this study was supplied by the Medical Research Department, Winthrop-Stearns, Inc., 1450 Broadway, New York 18, New York.

* U.S.P. designation for priodax.

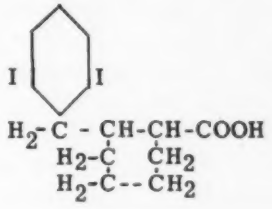
Unfavorable side effects following the oral administration of this compound occur infrequently and consist of nausea, mild diarrhea and, rarely, vomiting. Few patients have complained of a dryness of the mouth, urticaria or dysuria. In our experience, these symptom have never been of sufficient severity to interfere with the usual activities of the patient. Occasionally a patient has experienced sufficient nausea to induce vomiting, but this is rare. Not infrequently patients have complained of mild "cramps" in the lower abdomen, usually accompanied by a few diarrheal stools. At times we have found it necessary to prescribe a small amount of paregoric to control these symptoms. We have not observed any patients who developed skin rashes following the ingestion of this compound.

In thin and moderately large individuals the density of the gallbladder shadow obtained on the cholecystogram is adequate, but in larger individuals and in persons of the hypersthenic habitus the gallbladder shadow is not as dense in proportion or as satisfactory.

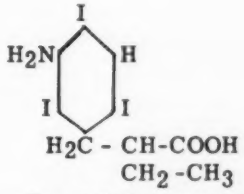
The cyclohexane carboxylic acid cholecystographic medium (monophen) is also a synthesized compound. It is a crystalline white powder, soluble in alkali and alcohol but insoluble in water. It differs from iodoalphionic acid in that it contains only one phenyl group. Cyclohexane carboxylic acid is stable and contains 52.2 per cent bound iodine by weight which is approximately the same amount of iodine as in iodoalphionic acid. The drug is eliminated mainly by way of the kidneys, 95 per cent being excreted in forty-eight hours—a somewhat more rapid rate than the other two compounds. It is packaged in a paper folder containing six to eight capsules with 0.5 gram in each for a total dosage of 3.0 to 4.0 grams. The capsules are large and of such a size that many patients find them difficult to swallow and less convenient than the tablet form. These capsules are



b (4-hydroxy-3,5, diiodophenyl)
a - phenyl propionic acid
(Priodax)



2 - (4-hydroxy-3,5-diiodobenxyl)
cyclohexane-carboxylic acid
(Monophen)



3-(3-amino-2,4,6, triiodophenyl) -
2-ethyl propanoic acid
(Telepaque)

Fig. 1. Chemical formulas of oral cholecystographic media under investigation.
β-(4-hydroxy-3,5-diiodophenyl)-α-phenylpropionic acid (priodax).
2-(4-hydroxy-3,5-diiodobenxyl) cyclohexane-carboxylic acid (monophen).
3-(3-amino-2,4,6-triiodophenyl)-2-ethyl propanoic acid (telepaque).

also ingested at about five minute intervals throughout the evening meal on the day preceding the examination without other requirements. Our experience with this carboxylic acid compound has been much less extensive, yet we have had the opportunity to use it enough during the past year to formulate our impressions about its efficiency for oral cholecystography. In general, the patients have found the large capsules somewhat objectionable as compared to the tablets and on this basis alone they nearly always chose the latter when given a preference. The only reactions that we have witnessed following the use of this compound were occasionally cramping pains in the lower abdomen, usually associated with mild nausea and nearly always with several loose stools. Skin rashes as evidence of sensitivity to the compound were not observed. A few patients complained of headaches but they were not of sufficient intensity be of significance. There was very little difference in the frequency of undesirable reactions in the patient following the administration of this medium and of iodoalphionic acid. The density of the gallbladder shadow obtained with the former in the thin or average person was satisfactory but that obtained in the obese or hypersthenic individual was proportionately less dense and thus not ideal.

The triiodo-phenyl propanoic acid compound (telepaque) is the latest of the newer cholecystographic media to be introduced. Initial reports on the clinical results with it have been published by us[6] and by Christensen and Sosman[1] in November, 1951, and in February, 1952, by Morgan and Stewart.[4] This chemical is a cream-colored powder that is insoluble in water but soluble in dilute alkali and in 95 per cent alcohol as well as other organic solvents. Like the cyclohexane carboxylic acid compound it has only one phenyl group but it contains 66.68 per cent iodine or 15 per cent more iodine than the other cholecystographic media by virtue of its triple iodine radicals. It is supplied in small glass phials of six tablets each containing 0.5 gram for a total of 3.0 grams as the average dose. The tablets are white and about the size and appearance of aspirin tablets.

The phenyl propanoic acid compound was made available to us for clinical trial in March, 1951, and since that time we have given it to over 300 patients without any effort at selection. It has been very satisfactory and we have had fewer patients complain of untoward symptoms. In fact, only 2 had cramping pains in the abdomen severe enough to mention it to us. These pains were accompanied by a few loose stools. Several patients were slightly nauseated, but none reported vomiting. No patients experienced diarrhea as a symptom following ingestion of the contrast medium. No skin rashes or other evidences of sensitivity occurred in this series. No complaints of dryness in the mouth or mucous membranes were recorded. It is our impression that this compound causes fewer unpleasant effects.

In all of the cholecystographic examinations only the single dose routine was employed. With all media the tablets or capsules were given at five minute intervals while the patient was consuming his evening meal. No attempt was made to standardize this meal in order to have it the same for all patients. Except for a selected group, the individual was instructed to follow the recommendations suggested by the manufacturer with reference to the selection of foods for this meal. After the evening meal, no additional food was permitted and breakfast on the following morning was eliminated. The patients were allowed small amounts of water but nothing else to drink.

The first cholecystogram was taken fourteen hours after the ingestion of the cholecystographic medium. If the gallbladder shadow was well demonstrated and no stones were present without question no further roentgenograms were made. This initial examination routinely consisted of posteroanterior and right anterior oblique views of the gallbladder. If the gallbladder shadow was faint, or overlying intestinal gas or fecal material partially

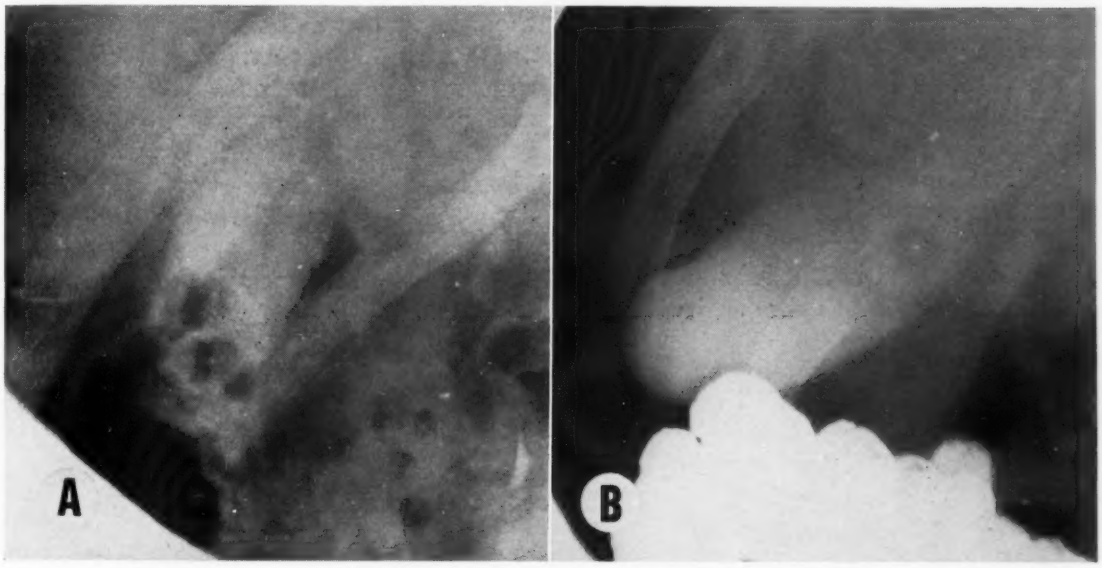


Fig. 2. Example of increase in density in gallbladder shadow gained by using the triiodophenyl propanoic acid compound over a "diiodo" compound.

(*A*) Fifteen hour cholecystogram after ingestion of 3 grams (6 tablets) of diiodophenyl propionic acid to a patient weighing 256 pounds. The gallbladder shadow is very faint. (*B*) Fifteen hour cholecystogram after ingestion of 3 grams (6 tablets) of triiodopropanoic acid by the same patient four days later. The gallbladder shadow is now of excellent density and much more satisfactory for interpretation.

obscured it, then subsequent films were made at fifteen and eighteen hours with the patient still fasting.

In the beginning the "fat meal" was reserved for use in only those cases in which at eighteen hours the examination was unsatisfactory with the hope that this meal would stimulate the emptying of the gallbladder, with the concentration of any small gallstones into clusters to improve the chance of their detection. At present we are using the "fat meal" in all cases. Our routine did not include cholecystograms taken in the erect position for the demonstration of small gallstones that might float to the surface and which otherwise might not be recognized. The number of stones that can be detected by the erect film over and above those shown by the posteroanterior and oblique views plus the "fat meal" film is probably inconsequential.

In order to gain some idea of the increase in the density of the gallbladder that might be obtained from using the triiodo-phenyl propanoic acid compound as compared with the "diiodo" compounds a series of the same patients were given each of these cholecystographic media after intervals of several days or weeks. In practically every

Fig. 3. The triiodophenyl propanoic acid compound is advantageous in the oral cholecystographic examinations of obese individuals and in those of hypersthenic habitus because it has a greater iodine content and therefore produces shadows of greater density. This fifteen hour cholecystogram was made on a man of this habitus weighing 250 pounds.

case the increase in density was sufficient to be readily apparent on direct inspection of the films. In fact it often appears to be more than one might expect from a 15 per cent increase in the iodine content of the triiodo-phenyl compound. An example of this observation is illustrated in Figure 2. One of the chief advantages possessed by this compound is that it produces gallbladder shadows of greater density in large individuals (Fig. 3). Another advantage of using the cholecystographic media with the higher iodine content is in the "border line" cases in which the gallbladder shadow is a little faint, but is normal in all other respects. In these instances shadows of satisfactory density can often be obtained, as demonstrated in Figure 4. Occasionally, gallbladder shadows that are not visualized by the "diiodo" cholecystographic media are well shown after the administration of the "triiodo" medium.

Some radiologists may object to the increased density of the gallbladder shadow obtained with the ethyl propanoic compound on the ground that it might obscure the shadow of small stones or papillomas. We have not found this to be the case, as even very small stones have been accurately demonstrated by our routine method, which can also be supplemented by taking films in the erect position or in the lateral decubitus position (Fig. 5, *A*, *B*, *C*). By and large, it seems to us that more errors occur in the interpretation of faint gallbladder shadows of poor contrast than in shadows of excellent density. Likewise the use of the triiodo propanoic compound produces shadows of greater density on cholecystograms of substandard quality which unfortunately appear all too frequently about the country. Every effort should be made to obtain films of excellent quality in every case and the use of the "triiodo" compund does not in any way sanction lower roentgenographic standards.

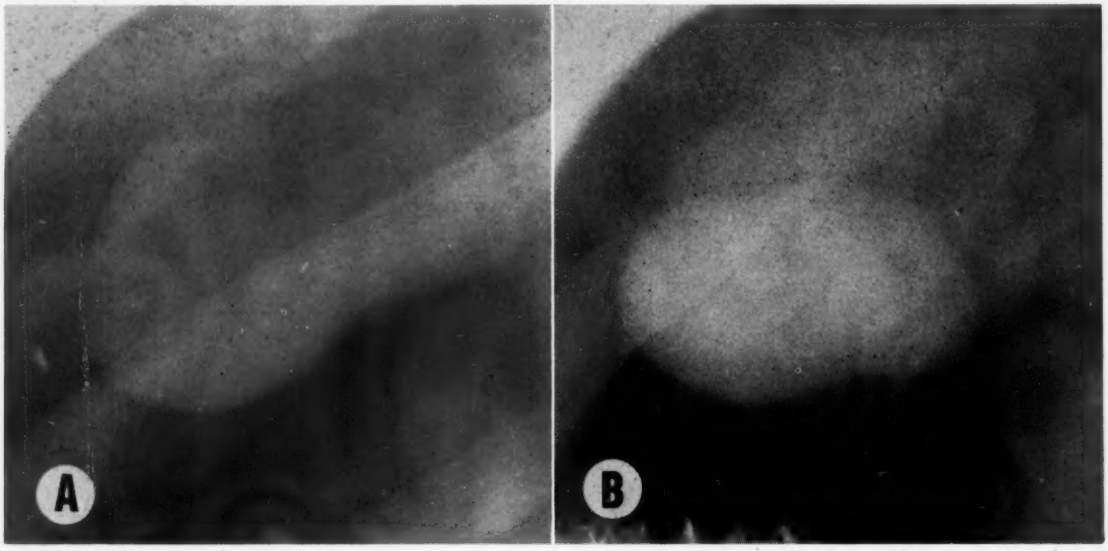


FIG. 4. Gallbladder shadows of faint density obtained after ingestion of "diiodo" cholecystopaque frequently become gallbladder shadows of excellent density by using the "triiodo" propanoic acid compound.

(*A*) Fifteen hour cholecystogram of faint density after ingestion of 3 grams (6 tablets) of iodoalphionic acid. (*B*) Same patient following ingestion of 3 grams (6 tablets) of triiodophenyl propanoic acid compound with production of a gallbladder shadow of excellent density at fifteen hours.

In an effort to determine the shortest time that a satisfactory gallbladder shadow could be obtained after ingesting the triiodo propanoic acid compound and whether it could be administered with a barium meal, we gave 15 unselected patients the usual

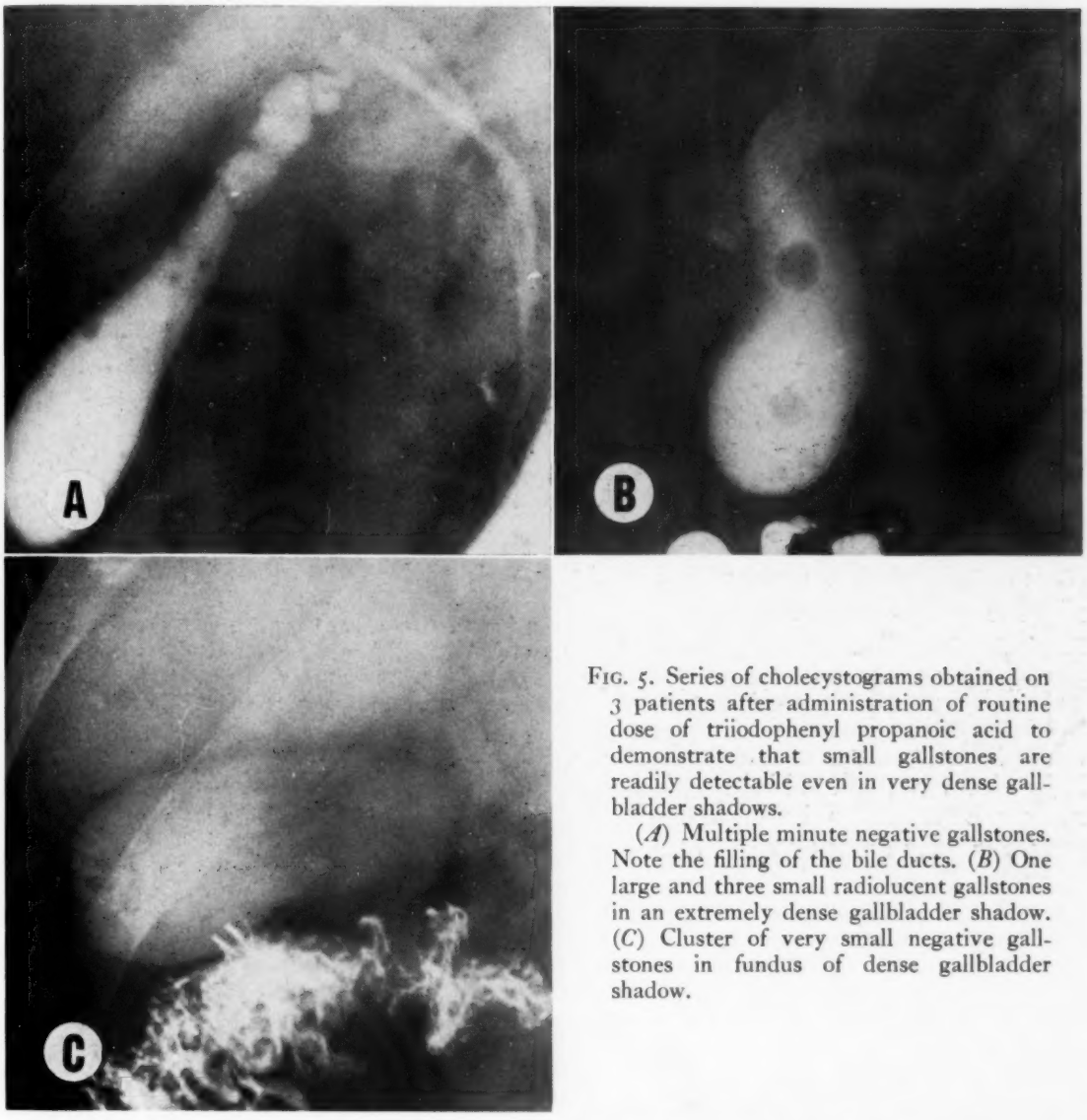


Fig. 5. Series of cholecystograms obtained on 3 patients after administration of routine dose of triiodophenyl propanoic acid to demonstrate that small gallstones are readily detectable even in very dense gallbladder shadows.

(*A*) Multiple minute negative gallstones. Note the filling of the bile ducts. (*B*) One large and three small radiolucent gallstones in an extremely dense gallbladder shadow. (*C*) Cluster of very small negative gallstones in fundus of dense gallbladder shadow.

dose of six tablets (3.0 grams) immediately after the ingestion of a barium meal for the examination of the upper gastrointestinal tract. Usually at the end of four hours and not longer than six hours the gallbladder shadow in all but one case was of a density satisfactory enough to warrant an accurate interpretation (Fig. 6). A similar test was conducted using iodoalphionic acid which appeared in the gallbladder in about the same length of time, but was of sufficient density for interpretation in only about half of the cases. The administration of a "triiodo" cholecystographic medium with the barium meal is not recommended as a routine procedure, but it can be employed if necessary. Similarly, it can be given early in the morning and satisfactory films can be obtained late that afternoon. However, if the gallbladder shadow is faint or if there is a question as to the presence of gallstones, the examination should be repeated by the established method.

Preliminary investigations were undertaken to determine if any additional advantage might accrue from the ingestion of larger doses of triiodo propanoic acid of 4.5 grams (9 tablets) and 6.0 grams (12

FIG. 6. Satisfactory cholecystogram obtained four to six hours after the ingestion of 3 grams (6 tablets) of triiodophenyl propanoic acid compound.

tablets). In a few cases in which these large doses were tried the gallbladder shadow appeared to be of only slightly greater density and perhaps a little larger as though it were distended. The biliary ducts were not visualized in greater detail or extent after the ingestion of the "fat meal." In general, the larger doses offer little or no advantage and at times can be a disadvantage because more of the unabsorbed radiopaque medium remains in the large intestine which may overlie a portion of the gallbladder. Smaller doses of 2.0 grams (4 tablets) are eminently satisfactory in patients weighing 150 pounds or less and of the sthenic or hyposthenic habitus (Fig. 7).

FIG. 7. Cholecystograms of excellent density are obtained in individuals of 150 pounds or less by using 2 grams (4 tablets) of the triiodo propanoic cholecystographic medium. This patient weighed 125 pounds.

FIG. 8. Satisfactory cholecystograms can be obtained by having the patient ingest the contrast medium with his usual evening meal and without subjecting him to a restricted diet or to a complicated ritual of behavior. Very satisfactory cholecystograms result even when the tablets are taken with an evening meal rich in fats which the patient has prepared, as illustrated in this cholecystogram.

For some time we have had the idea that it was not necessary for patients who were undergoing a cholecystographic examination to restrict the evening meal to a list of limited foods and to follow a strict ritual against the inhalation of food odors and similar fetishes. To test this idea, 15 unselected consecutive patients were given the "triiodo" cholecystographic medium with instructions to ingest it with an evening meal consisting of foods rich in fat

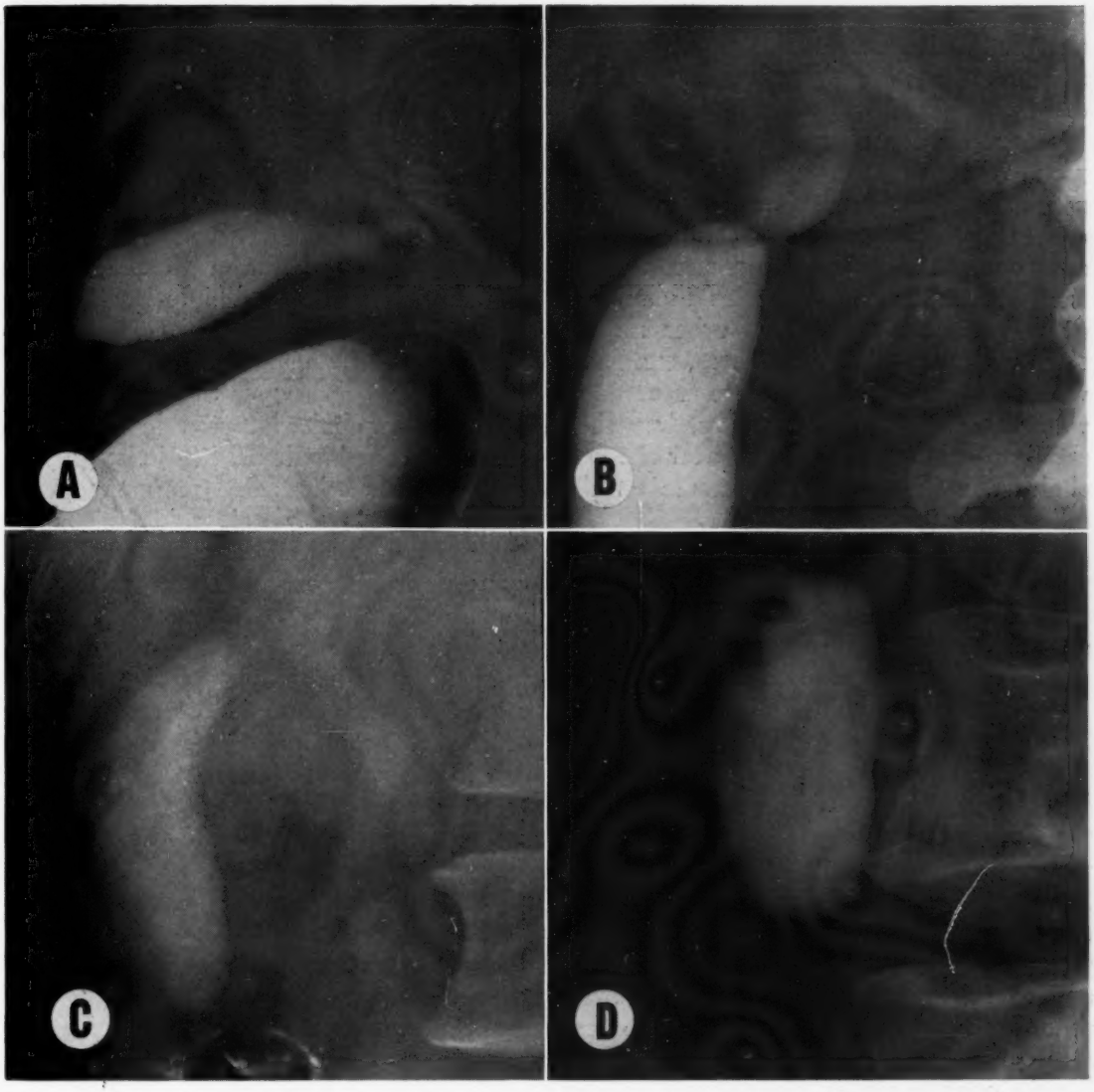


Fig. 9. (*A*) (*B*) (*C*) (*D*). The greater radiopacity of the triiodophenyl propanoic acid provides much more frequent opportunities for the visualization of the valves of Heister, the cystic, hepatic and common bile ducts. They can usually be demonstrated about five to fifteen minutes after the "fat meal."

which had formerly been prohibited. They were urged to either cook the meal themselves or to be in the kitchen while it was being prepared. Most of these meals consisted of fried pork sausage, fried potatoes, eggs, large helpings of butter, a glass of half cream and half milk, bacon, pork chops, and similar foods of their own choice. Of these cases 9 resulted in excellent gallbladder shadows, 3 were of a very satisfactory density, 2 were fair but sufficient for accurate diagnosis, and in 1 case the gallbladder was not visualized. In 4 cases negative gallstones were clearly demonstrated and 2 of these patients were very large weighing 180 pounds. It was interesting to note that in none of these cases did the patients complain of undue symptoms and none of them experienced nausea or vomiting (Fig. 8).

A similar test was conducted using iodoalphionic acid as the contrast medium. While a smaller number of gallbladder shadows of excellent density were obtained

in this group, the ingestion with a meal rich in fat did not interfere with the absorption of the compound and did not produce untoward symptoms.

For routine purposes we do not recommend that the newer cholecystographic media be ingested with a meal of high fat content. We do recommend that the instructions be simplified to permit the patient to take the tablets with their usual evening meal and without other restrictions with respect to food odors, etc. Likewise they may have moderate amounts of water throughout the evening, but they should continue fasting until after the first cholecystograms have been made on the following morning.

The employment of the triiodo-phenyl propanoic acid compound which provides gallbladder shadows of greater density makes possible a more satisfactory roentgenoscopic examination of the gallbladder. This is done with the patient standing in the erect position to allow the gallbladder to drop down into the most dependent position below the ribs where it can be palpated. We are not yet certain as to the value of the roentgenoscopic examination, but it does give the radiologist an opportunity to determine the mobility of the gallbladder, the flexibility of its walls, and to shift about questionable negative shadows that might simulate gallstones. As yet we have not been successful in forcing the opaque contents of the gallbladder into the cystic, hepatic and common ducts in large enough quantities to visualize them and to make spot roentgenograms. Whether the roentgenoscopic examination will provide enough extra information to justify the time and effort, we are not prepared to say at this time. It does present another approach in the examination of the gallbladder and biliary tract.

With the routine use of the triiodo propanoic acid cholecystographic medium the cystic, hepatic and common ducts are visualized very frequently on the cholecystograms taken about fifteen minutes after the ingestion of the "fat meal" (Fig. 9). With the other cholecystographic media the appearance of these ducts was infrequent. Again the length of the period of study has been insufficient to appraise the value of observing the ducts in the diagnosis of gallbladder and biliary tract disease. It can be said that now there is a greater opportunity to demonstrate these ducts then ever before with the hope of securing information of clinical value.

CONCLUSIONS

The newer cholecystographic radiopaque media, iodoalphionic acid (priodax), cyclohexane carboxylic acid (monophen) and triiodo-phenyl propanoic acid (telepaque) have made cholecystography a simple, convenient and accurate test of gallbladder function.

Of these compounds the newest, the phenyl propanoic acid, is the only "triiodo" compound with three iodine radicals. The other two are "diiodo" compounds with two iodine radicals. The phenyl propanoic acid compound contains 15 per cent more iodine than the others. This increased iodine content largely explains why it produces gallbladder shadows of greater density.

For this same reason the phenyl propanoic acid compound can be ingested in the morning and satisfactory cholecystograms obtained the same afternoon. It can be administrated immediately after the barium meal in the morning and excellent cholecystograms made four to six hours later, but this is not recommended as a routine procedure.

The increased iodine content of the triiodo propanoic acid compound is of special value in the examination of large or obese individuals and those of a hypersthenic habitus.

In patients weighing 150 pounds or less the dosage of the phenyl propanoic acid compound can be reduced to 2 grams (4 tablets) and cholecystograms of excellent density can still be obtained.

The triiodo propanoic acid compound is

better tolerated with fewer unfavorable reactions.

The dense gallbladder shadow obtained with this cholecystographic medium makes possible a more satisfactory roentgenoscopic examination and palpation of the gallbladder.

The increased density of the triiodo propanoic acid compound in the gallbladder frequently results in the demonstration of the cystic, hepatic and common ducts on the cholecystograms made about five to fifteen minutes after the ingestion of a "fat meal" and provides a more frequent opportunity for the study of these structures.

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THE USE OF THE ROENTGEN RAY IN THE DIAGNOSIS AND THERAPY OF FAULTY OVULATION*

By WALTER W. WILLIAMS, M.D.†
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THE use of small doses of roentgen radiation in the therapy of infertility has followed the observations of Kaplan,[3] Mazer and Israel,[4] Haman,[2] and others, that such therapy often influences favorably the character of the menstrual cycle, correcting functional bleeding and increasing the fertility. Faulty ovogenesis may be clinically associated with various etiological factors (Fig. 1), some genetic, others acquired, and the prognosis and therapy varies in accordance.

It will be attempted here to distinguish more clearly the types of cases which may be benefited by roentgen therapy.‡[1] For this, I have tabulated a group of 412 cases from my practice and in which the ovulation phenomena have been studied by various criteria during the course of routine sterility investigations, including cervical pathology, endometrial biopsies and basal body temperature records. Particular attention is focused upon the basal body temperature patterns, since, with but few exceptions, they serve to reflect cyclic ovarian

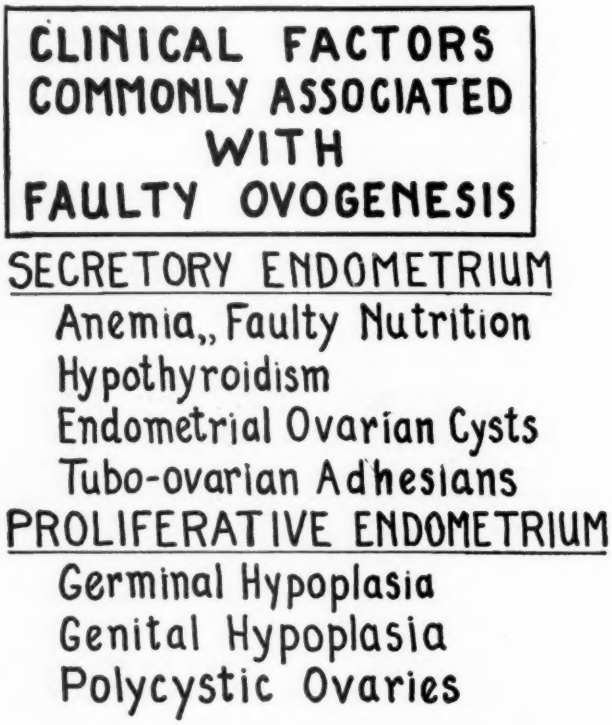

FIG. 1. Etiology of abnormal ovulation.

‡ 140 kv., and 15 ma., at a distance of 50 cm. and 5 mm. of aluminum filtration, which gives a half-value layer of 0.47 mm. copper, through an anterior pelvic field 20 by 20 cm. The pituitary was treated at the same time at the same distance through a portal of 5 by 5 cm. The roentgen dosage was 75 roentgens at each treatment, making a total dosage of 225 r to the pelvis and 225 r to the pituitary.

* Presented before the Thirty-third Annual Meeting, American Radium Society, Atlantic City, N. J., June 7–9, 1951.
† Geneticist, Springfield Hospital, Springfield, Massachusetts.

changes (Fig. 2). Based on these observations, 58.5 per cent of this group of 412 cases were ovulating essentially normally, whereas 171, or 41.5 per cent, gave evidence of abnormal ovogenesis. Of these, 116 cases (28 per cent of the entire infertile group) exhibited bimodal curves but marked cyclic irregularities which suggested a disturbance of ovogenesis. Fifty-five cases, or 13.5 per cent, of the total infertile cases presented no evidence of ovulation over long periods of time. Whereas 25 per cent of the group with irregular ovulations conceived, there was in this group 27 cases, receiving roentgen therapy, with a conception ratio of 41 per cent. In the 55 anovulatory cases, in which monomodal basal body temperature curves were the rule, 33 per cent conceived. Twenty-three out of the 55 anovulatory cases received roentgen therapy, of which 16, or 69 per cent, conceived and delivered normal babies (Fig. 3). Actually, there were 18 conceptions in the group of 55 anovulatory cases and 16 out of the 18 received roentgen therapy prior to conception, thus providing considerable evidence of the value of roentgen therapy to the ovaries and pituitary in this particular type of case.

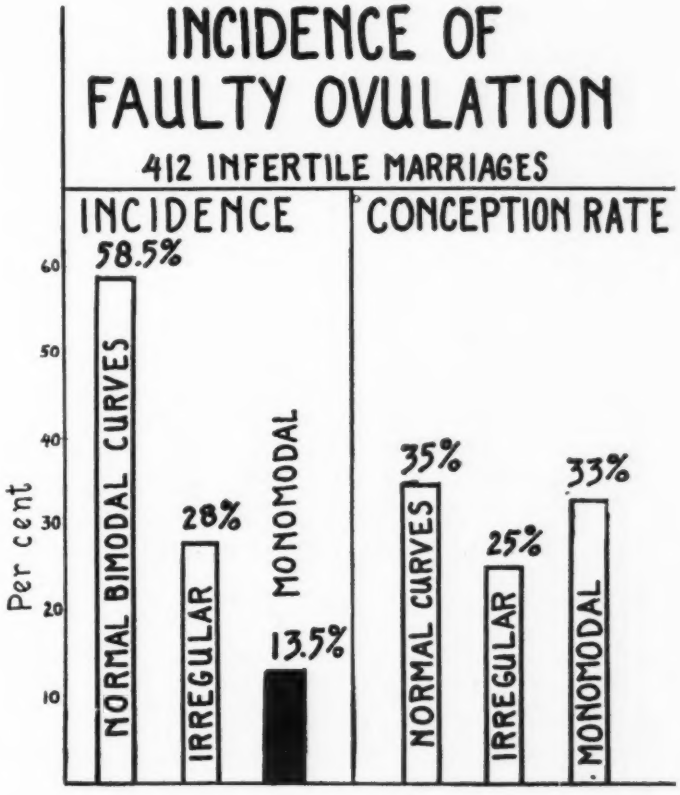

Fig. 2. Incidence of abnormal ovogenesis.

To a certain extent, careful clinical examinations will serve to foretell the cases in which roentgen therapy is indicated. This will be attempted by means of a review of a few typical cases of ovular disorders.

A normal bimodal basal body temperature record from a normal fertile woman is illustrated in Figure 4. The temperature shift or ovulation shift occurred month after month on either the thirteenth or fourteenth day of the cycle and conception occurred from a single isolated sexual intercourse on the day of temperature shift. Such basal body temperature curves are

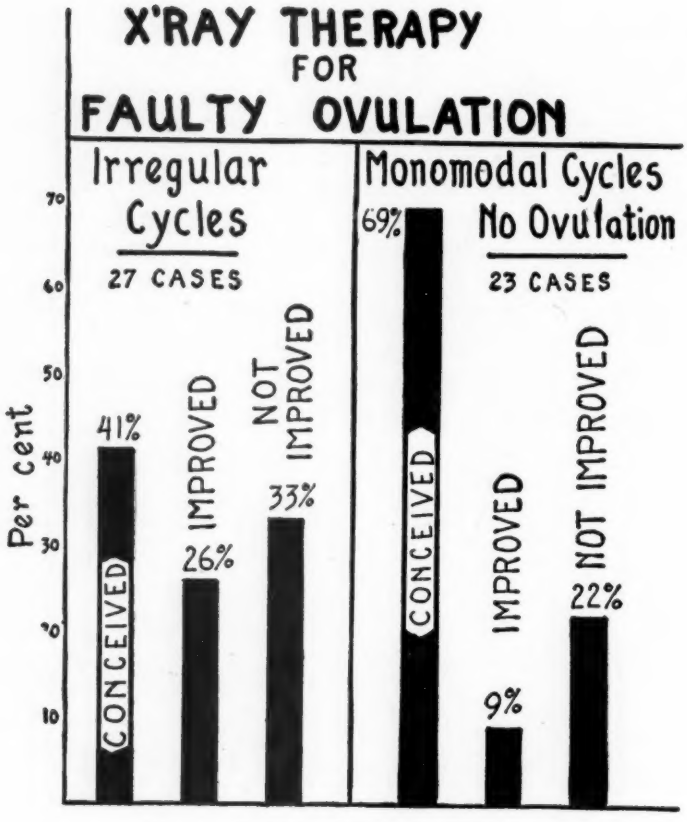

FIG. 3. Results of roentgen therapy.

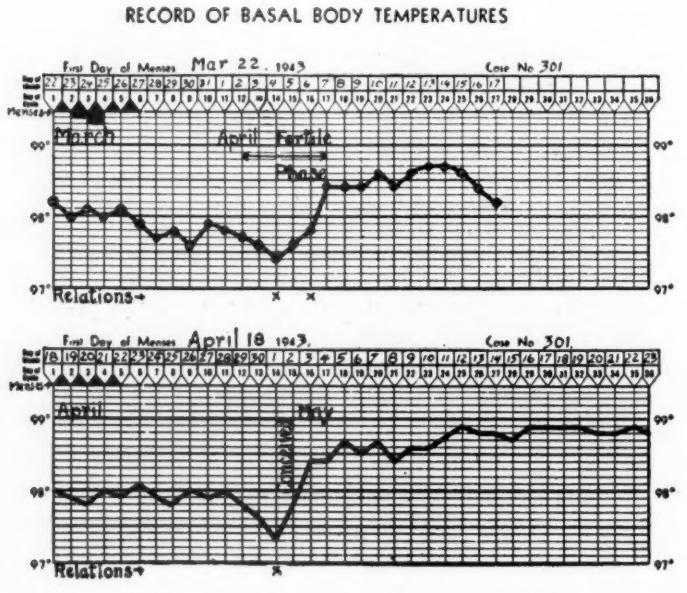

FIG. 4. Normal basal body temperature as index to quality of ovulation.

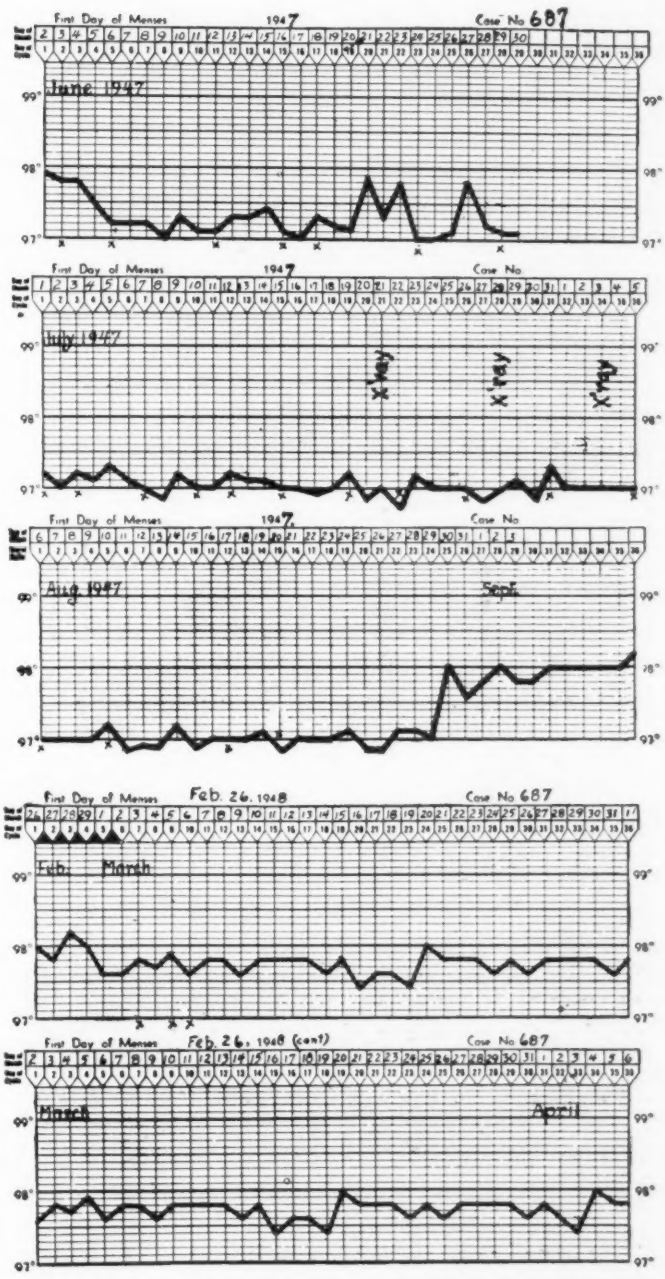

FIG. 5. Germinal hypoplasia. Case 687. Basal body temperatures elevated after roentgen therapy and conception.

typical of highly fertile women and any marked deviation from this fundamental pattern suggests faulty ovulation. In general, it may be considered that the occurrence of a constant type of bimodal basal body temperature curve, with cycles of uniform length, and a postovulatory rise at about the same day of each cycle, furnishes reasonably good evidence of normal ovulation and, conversely, that any deviation from this fundamental pattern is highly suggestive of faulty ovulation.

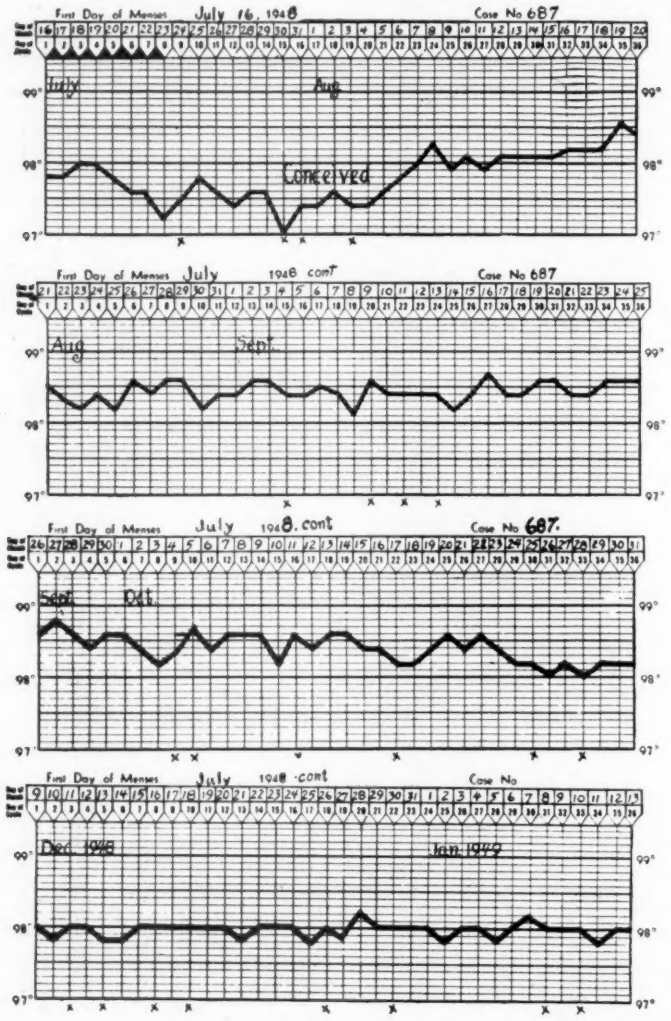

FIG. 6. Germinal hypoplasia. Case 687. Basal temperatures of pregnancy.

Figures 5 and 6 show the low monomodal type of basal temperature curves of a woman who had been amenorrheic for a period of seven years and who had been considered as incurably sterile. The ovaries and uterus were of normal development and the secondary sexual characteristics were likewise normal. A sharp elevation in the basal body temperature level followed about four weeks after the first roentgen treatment, and this elevation continued over a period of two months. Then a sharp drop in the temperature level indicated ovulation. Conception occurred at this point, followed by the uniformly high temperature level such as is commonly associated with normal gestation. This case is given to illustrate not only the ab-

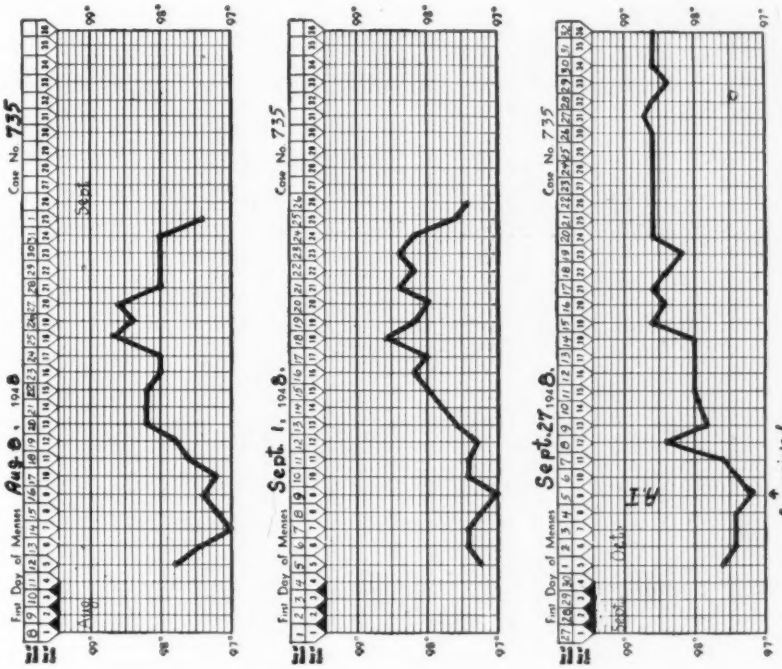

Fig. 7b. Irregular bimodal basal body temperatures. Case No. 735. After roentgen therapy.

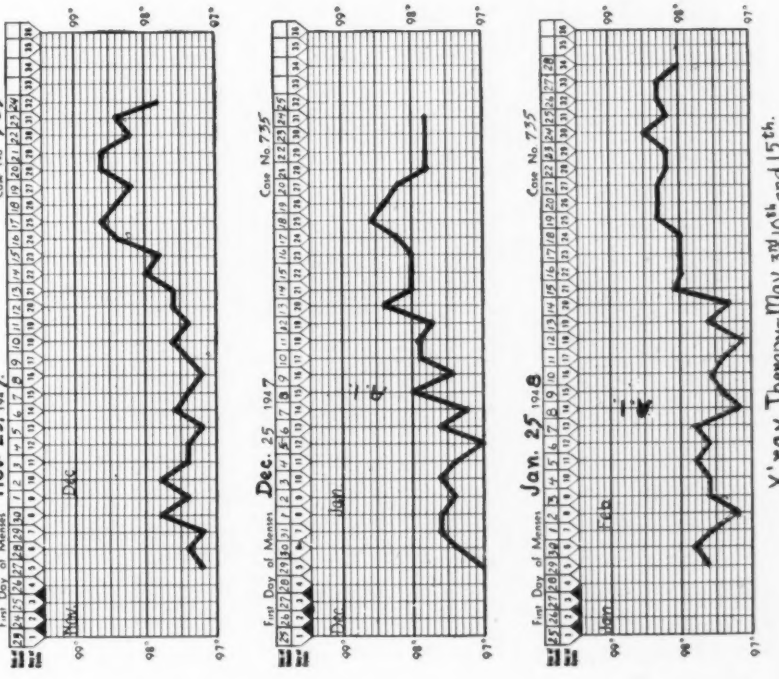

Fig. 7a. Irregular bimodal basal body temperature. Case 735. Corrected by roentgen therapy and conception.

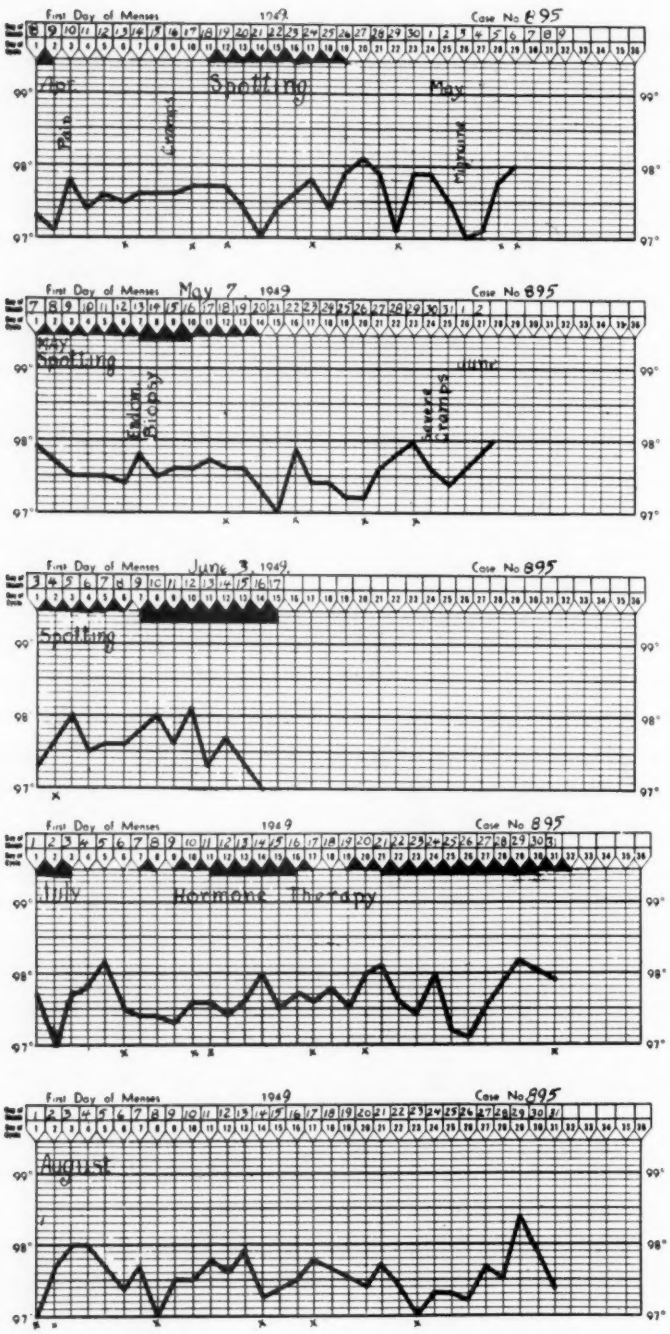
First Day of Menses 1949 Case No 895
Apr. Spotting May
Pain Cramps Pressure
First Day of Menses May 7, 1949 Case No 895
May Spotting June
Edem Bloat Severe Cramps
First Day of Menses June 3, 1949 Case No 895
Spotting
First Day of Menses 1949 Case No 895
July Hormone Therapy
First Day of Menses 1949 Case No 895
August

FIG. 8. Menorrhagia and irregular cycles. Case 895. Basal body temperatures.

normal temperatures of anovulation, but the common temperature changes following roentgen therapy and pregnancy in cases of germinal hypoplasia.

Figures 7a and 7b show the basal body temperature record of a woman who had been married for fourteen years. Routine clinical examinations were negative except for the fact that the thermal shifts were poorly defined. Her husband being aspermic, she had been inseminated upon numerous occasions with semen from different foreign donors but failed to conceive. A decided change is noted in the character of the basal body temperature curve after roentgen therapy, and conception occurred at the first insemination after this therapy.

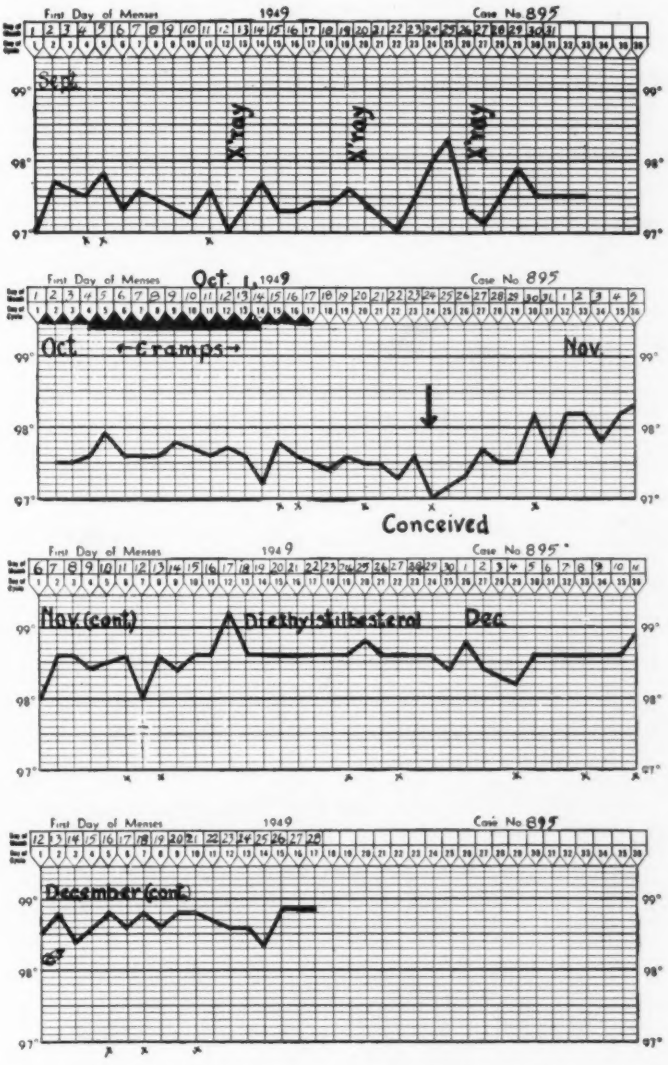

Fig. 9. Menorrhagia and irregular cycles. Case 895. Basal body temperatures. Cured by roentgen therapy.

Several other cases with irregular bimodal cycles have reacted in a like manner, but most of the cases with abnormal biphasic basal body temperature curves have not improved after roentgen therapy.

Cyclic changes in the ovary may be sufficient to induce cyclic bleeding but in-

adequate to cause normal secretory changes in the endometrium. Such a case is illustrated in Figures 8 and 9, with irregular, excessive bleeding, no evidence of ovulation and sterility of seven years' duration. Before roentgen therapy, the basal body temperature curves were monomodal and jagged, but it will be noted that soon after therapy, a sharp rise in the basal body temperature indicated the occurrence of ovulation and the continued high level signified conception.

Figure 10 gives the gynecography picture of an anovulatory woman with ovaries and uterus of normal size. She had been sterile for eight years. Clinically, the woman possessed normal secondary sexual attributes. The basal body temperature ran at a rather constant level of about 97° F. After roentgen therapy, there was an immediate change in the character of the temperature curves and, on the third month after therapy, a definite temperature shift indicated ovulation, followed by the typical elevated temperatures of pregnancy (Fig. 11).

FIG. 10. Germinal hypoplasia. Case 911. Gynecography.

Genital hypoplasia is illustrated in Figures 12, 13 and 14. Here the character of the basal body temperature is not greatly dissimilar to that pictured previously in the case of germinal hypoplasia (Fig. 11). Both of these genital hypoplasia cases were amenorrheic. Neither exhibited any response either from cyclic hormonal therapy or roentgen therapy, and the basal body temperature continued at a low constant level. Any therapy with this type of case seems quite futile.

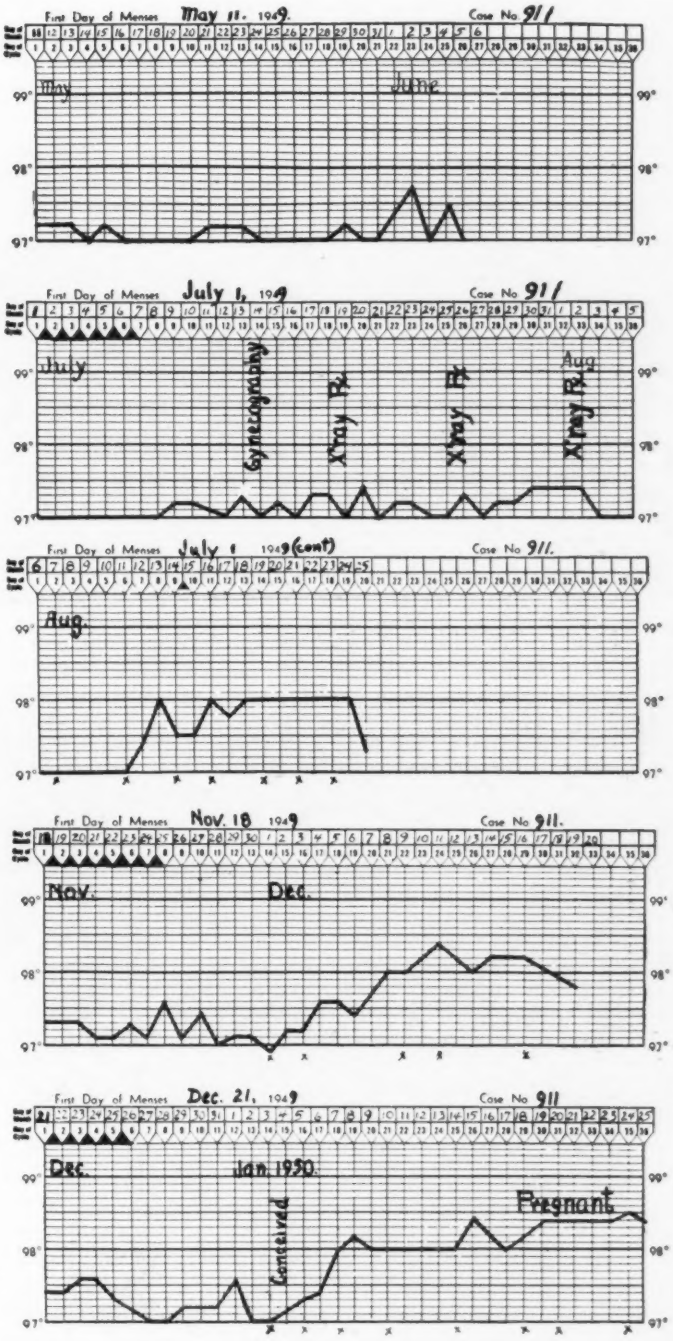

FIG. 11. Germinal hypoplasia. Case 911. Basal body temperatures before roentgen therapy, and after roentgen therapy and conception.

FIG. 12. Genital hypoplasia. Case 631. Gynecography.

FIG. 13. Ovarian hypoplasia and menopause. Case 933. Gynecography.

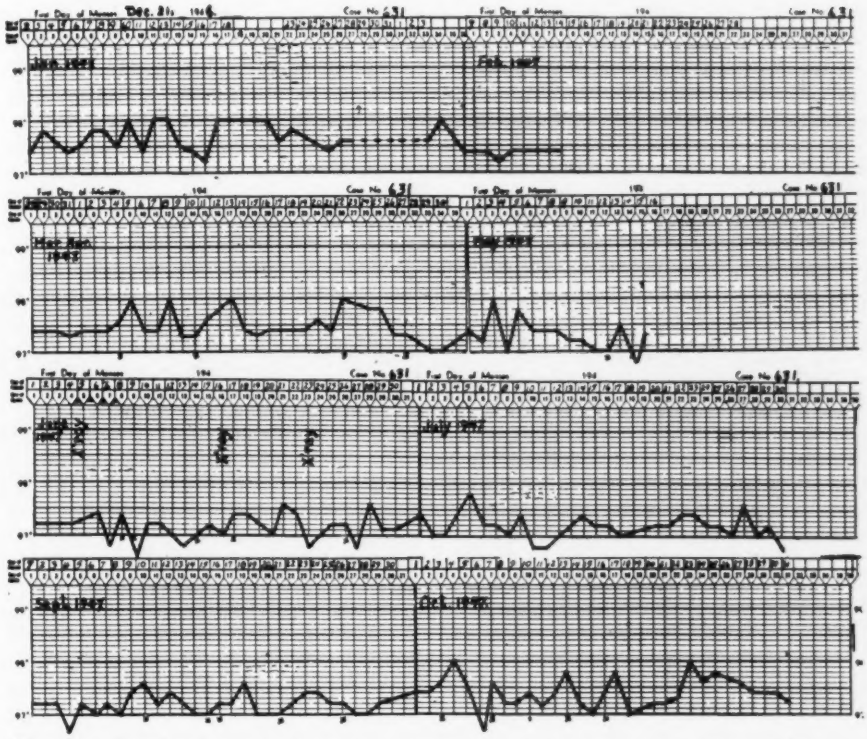

Fig. 14. Ovarian hypoplasia and menopause. Case 933. Basal body temperatures.

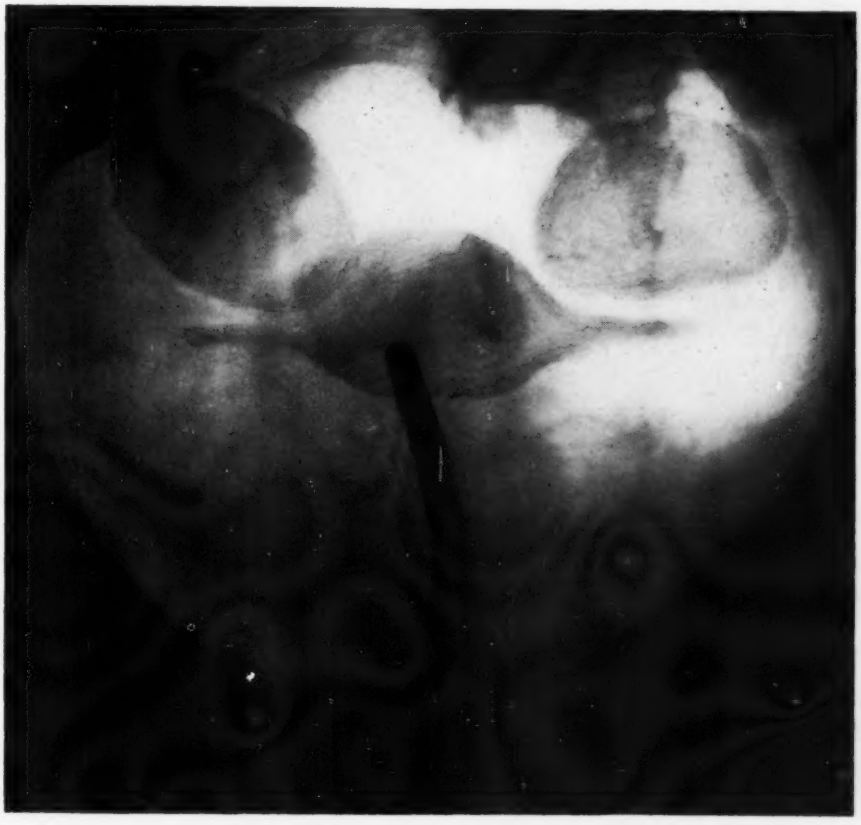

Fig. 15. Polycystic ovaries. Case 1030. Gynecography.

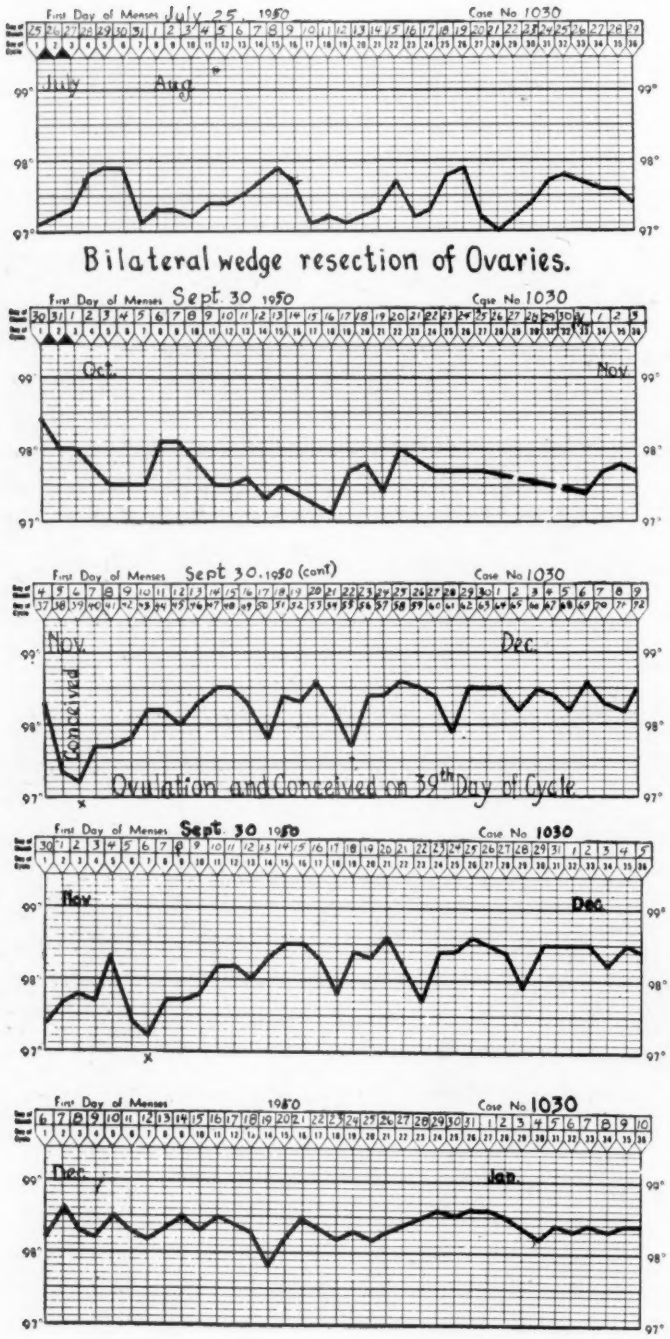

FIG. 16. Polycystic ovaries. Case 1030. Basal body temperatures before and after ovarian resection.

Fig. 17. Endometrial ovarian cysts. Case 694. Gynecography.

Polycystic ovaries are illustrated in Figures 15 and 16. In this disorder, there is a bilateral enlargment of the ovaries, amenorrhea, absence of ovulation, and frequently hirsutism. The basal body temperature graph is in consequence of a monomodal type. It is generally regarded after resection of the endometrial cysts. This one did not conceive.

The inclusion of the ovaries in firm pelvic adhesions may mechanically interfere with ovulation. Such a case is illustrated in Figure 19, both ovaries being buried in dense pelvic adhesions. This interfered

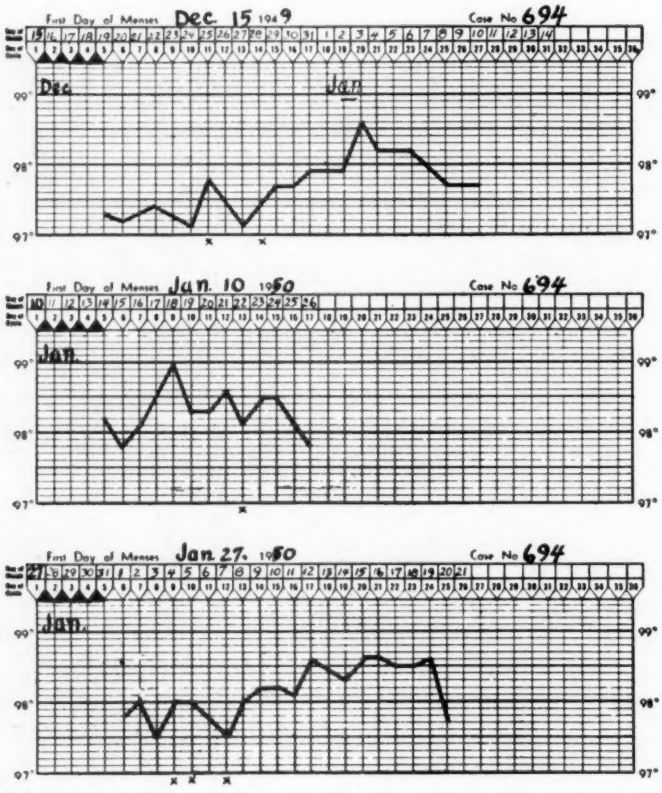

FIG. 18. Endometrial ovarian cysts. Case 694. Basal body temperatures.

that endocrine therapy and deep roentgen therapy are of no value in this disorder. An ovulation depression and conception occurred about eight weeks after ovarian resection.

The gynecography of bilateral endometrial ovarian cysts is shown in Figure 17. It is to be noted that although the cycles are very irregular, the marked difference in temperature level suggests a lutein or secretory phase (Fig. 18). This was confirmed by endometrial biopsy. As far as is known, this type, as well as other types of ovarian cysts, is not amenable to roentgen therapy. Many such patients will conceive with ovulation and resulted in monomodal basal body temperature curves (Fig. 20) which were, however, associated with a secretory type of endometrium, thus indicating that ovulation had occurred in spite of the lack of substantiating temperature evidence. After freeing one of the ovaries of its adhesions, normal menstrual cycles with normal bimodal type of temperature curves were established.

Another condition which occasionally interferes with ovulation is a low basal metabolic rate, where one may observe a monomodal type of basal body temperature curve with a considerable variability

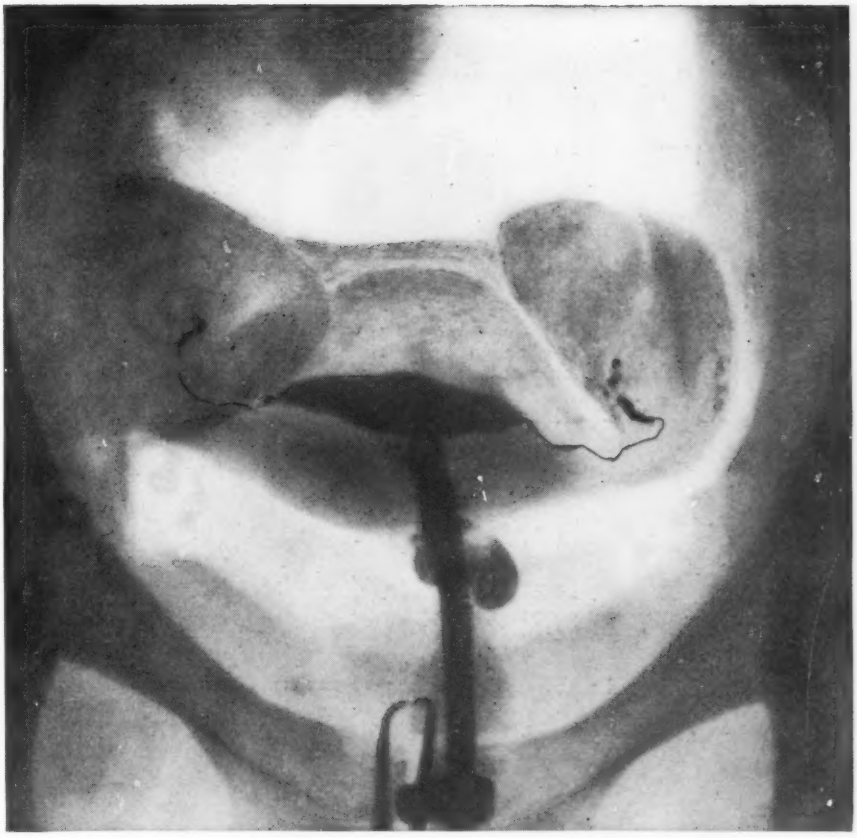

Fig. 19. Adnexal adhesions. Case 830. Gynecography.

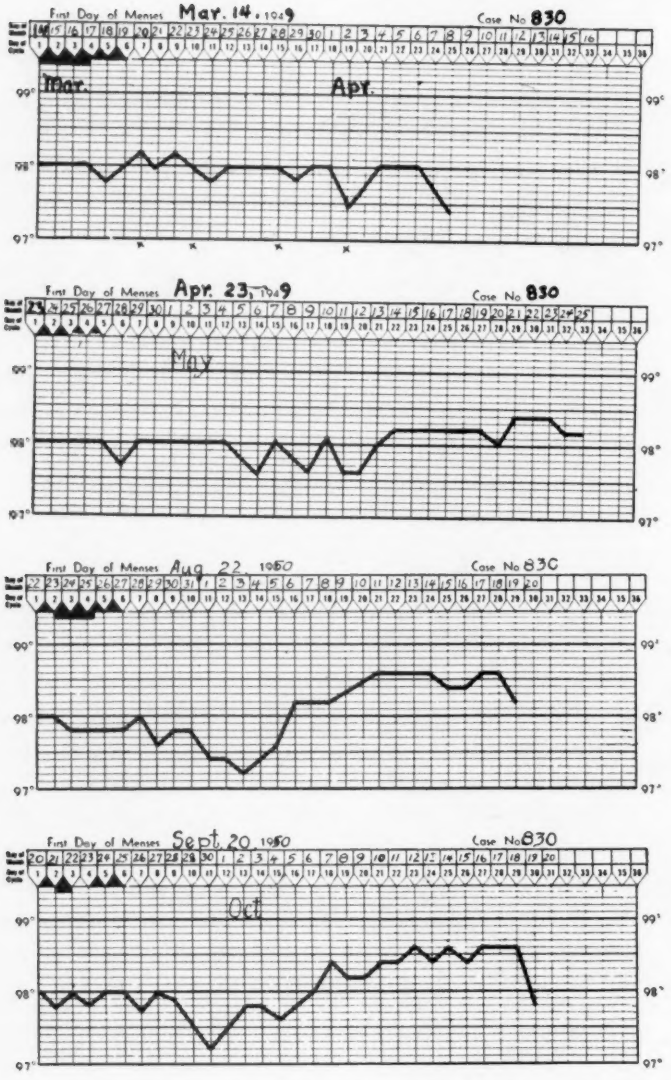

FIG. 20. Adnexal adhesions. Case 830. Basal body temperatures before surgery and after lysis of adhesions.

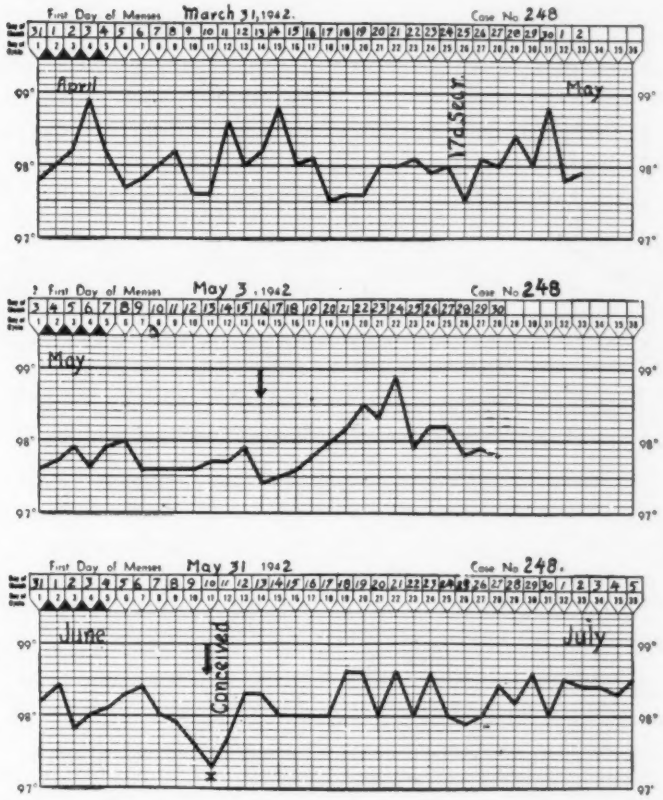

Fig. 21. Hypothyroidism. Case 248. Basal body temperatures before and after thyroid therapy.

in the temperature level from day to day. The temperature commonly runs at a higher level than observed with a germinal hypoplasia (Fig. 21). In this type of case, a secretory type of endometrium is usually present, in spite of the monomodal pattern of temperature curve. After thyroid therapy, the time of ovulation became more apparent and conception occurred promptly as a result of a single isolated insemination. Roentgen therapy is not indicated in such cases.

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DISCUSSION

Dr. Douglas J. Roberts, Hartford, Conn. The American Society for the Study of Sterility in which Dr. Williams is a director holds its annual meeting here in Atlantic City following our American Radium Society meeting. In view of the increased attention given to the role of roentgen therapy by that society in the last few years it would seem that more interest than has been accorded heretofore by our own American Radium Society was appropriate.

It is a pleasure to discuss Dr. Williams' paper on the use of roentgen radiation in sterility of the female. Too long has its use in the past been along a somewhat empirical line based on clinical results without sufficient knowledge as to why and how these were obtained. With a favorable result in about 40 per cent of the

patients treated, Dr. Williams now has shown us how to select our patients for this procedure so that the 60 per cent failures may be handled by other means.

It is regretted that Dr. Ira I. Kaplan, who has had so much experience in this field, could not be here to join in the discussion. In his recently published series of 413 patients treated, pregnancy resulted in 168 women and of the 172 children that were born to these mothers he found no physicial abnormalities that suggested any damage from the roentgen radiation effect on the ovaries. He has stated that there are now 5 grandchildren in this series none showing any evidence of abnormality.

Our own series of cases is much too small to be of significance but the results are approximately the same as reported elsewhere. The technique followed has varied from treatment of the pituitary and ovarian areas separately and together. The course generally followed at present is that used by Mazer and Israel and by Haman with the following factors: 140 kv., 15 ma., 50 cm. distance, 5 mm. Al filtration, giving a half-value layer of 0.47 mm. Cu; 75 r is delivered in air through a 5 cm. portal to a lateral pituitary area and 75 r in air through a 15 by 15 cm. anterior portal over the ovaries, both areas treated the same day once a week for three weeks.

Vol. 69, No. 1

THE AMERICAN JOURNAL OF ROENTGENOLOGY, RADIUM THERAPY AND NUCLEAR MEDICINE

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Published by: Charles C Thomas, Publisher, 301–327 East Lawrence Avenue, Springfield, Illinois.

Issued monthly. Annual subscription: United States, Mexico, Cuba, Central and South America, $15.00; Canada, $16.00; other countries, $17.00. Current single numbers, $1.50. Advertising rates submitted on application. Editorial office, 110 Professional Building, Detroit 1, Michigan. Office of publication, 301–327 East Lawrence Avenue, Springfield, Illinois. Information of interest to authors and readers will be found on page iv.

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Representatives on National Committee for Radiation Protection: Edith H. Quimby, New York, N. Y., John E. Wirth, Pasadena, Calif.

Thirty-fifth Annual Meeting: Chase Hotel, St. Louis, Mo., April 19, 20, 21 and 22, 1953.

EDITORIAL

TELETHERAPY WITH VARIOUS RADIOACTIVE SOURCES

GAMMA-RAY beam therapy with radium as the emitting source has been successfully used for many years. The first units usually contained 1 to 5 grams of the element and protection from the stray radiation was provided by means of lead and heavy tungsten alloys. In some of the units, the source was permanently housed in the treatment container; in others, it was automatically loaded and unloaded with the aid of mechanical or pneumatic systems in order to enhance the protection afforded the operator while positioning the patient for treatment. Because of the low intensity of the gamma-ray beam produced by these sources, treatment usually had to be applied at close range, the radium skin distance rarely exceeding 8 centimeters. Lately, due to the availability of larger amounts of radium, several 10 gram units[1,2] have been constructed and the tungsten alloy has been replaced by uranium metal providing more efficient absorption of the stray radiation. Thus a significant increase of the dose rate was obtained, varying from 8 to 17.5 roentgens per minute—at distances of 8 to 12 cm. The two largest units at the present time are the 50 gram units: one installed at the Cancer Institute of the University of Louvain, Belgium, under the directorship of Professor J. Maisin, and the other installed at the Janeway Clinic of the Roosevelt Hospital, New York City, under the directorship of Dr. Douglas Quick.

The development of nuclear reactors has resulted in the gradual availability for medical purposes of a variety of artificially produced radioactive sources. This has led to two very definite trends in the development of beam therapy with gamma rays. On the one hand, there has been a tendency to continue to treat at short distances utilizing some artificial radioactive source of equivalent strength in place of the radium housed in containers of conventional design; on the other, attempts have been made to build large units which would permit gamma irradiation at considerably greater distances along similar lines as practiced in supervoltage or megavoltage roentgen therapy. To distinguish more clearly between these two types of procedures, it may perhaps not be out of place to suggest at this stage of development that the name of teletherapy be reserved only for the treatment at greater distances and that the former method of gamma-ray beam therapy at shorter distances be called plesiotherapy thus giving expression to the fact that the irradiation is being carried out "near" the source.

Dr. Marshall Brucer,[3] chairman of the Medical Division of the Oak Ridge Institute of Nuclear Studies, who has made outstanding contributions to the study of the medical usefulness of various isotopes, states that there appear to be six practical isotopes with characteristics suitable for gamma beam therapy: iridium (Ir^{192}), cobalt (Co^{60}), europium ($Eu^{152-154}$), tantalum (Ta^{182}), cesium (Cs^{137}) and cerium (Ce^{144}). The first four can be efficiently pro-

[1] Martin, J. H., Tulley, T. J., and Harriss, E. B. Report on installation of ten gramme teleradium unit. *Brit. J. Radiol.*, 1949, *22*, 44–48.

[2] Wilson, C. W. Some developments of physical aspects of teleradium therapy. *Brit. J. Radiol.*, 1951, *24*, 374–380.

[3] Brucer, Marshall. New developments in teletherapy. *Nucleonics*, April, 1952, *10*, 40–46.

duced in a nuclear reactor with thermal neutrons, while the last two can be obtained by separation from mixed fission products.

Of these newer isotopes, radioiridium and radiocobalt have been successfully used during the past few years for short distance gamma beam irradiation, or plesiotherapy. In 1950, Freundlich, Haybittle and Quick[4] described a 20 curie radioiridium unit which has been installed at the Radiotherapeutic Centre, Addenbrooke's Hospital, Cambridge, England. This unit yields 11 r per minute at 8 cm. source distance and weighs only 50 pounds. In a somewhat later publication, Mitchell[5] states that the unit has been in routine use since May, 1950, and that it has proved practical. The gamma-ray beam emitted has a half-value layer of 8.1 mm. of copper, corresponding to the quality of a roentgen-ray beam produced by an 800 kv. apparatus. The dose distribution differs very little from that observed in similar radium units. Because of the short half-life of seventy days, the radioiridium source has to be changed once a month. The use of radiocobalt for short distance gamma-ray beam therapy was reported by Merewether, Osborn and Wyard,[6] who replaced the 5 gram radium source in their unit by a 6 curie Co^{60} source which is the equivalent of 10 grams of radium, and by Lidén,[7] who installed a new 10 curie Co^{60} unit. According to the measurements of Merewether and her co-workers the gamma beam emitted by the Co^{60} source has a half-value layer of 10.5 mm. of lead which is slightly less than that observed with 4 mev. roentgen rays. More recently, attempts are also being made to build similar short distance therapy units containing Cs^{137} and Ta^{182} as the radioactive sources.

In devising units for gamma-ray beam therapy at greater distances, that is the gamma teletherapy in the sense conceived for roentgen therapy, the greatest progress has been made so far with the use of the radiocobalt. This element has many attractive properties. It emits a 0.3 mev. beta ray, most of which is absorbed in the source itself, and two relatively close gamma rays of 1.17 and 1.33 mev. energies in equal ratio. It can be produced and conveniently assembled in high intensity sources, and it has a half-life of 5.3 years. The first two units, containing 1,000 curie Co^{60}, were placed in operation in Canada, one at the University of Saskatchewan, Saskatoon, in August, 1951, and the other at the Victoria Hospital, London, Ontario, in October, 1951. The radioactive cobalt for both of these units was supplied by the Isotope Production Branch of the Canadian atomic pile at Chalk River. Johns,[8] Watson,[9] Dixon, Garrett and Morrison,[10] Johns, Epp, Cormack and Fedoruk,[11] Smith,[12] and Green and Errington[13] gave a detailed account of the various problems encountered in the installation of such units and they presented accurate physical data as well as some initial clinical impressions on the merit of this type of therapy. The initial output was found to be approximately 30 to 35 roentgens per minute at 80 cm. source skin distance and the depth dose with a 20 by 20 cm. field amounted to 60.3 per cent. In general, the physical measurements gave values which were similar to those obtained with a 3.5 mev. roentgen apparatus. Both units were found to be flexible and required

[4] Freundlich, H. F., Haybittle, J. L., and Quick, R. S. Radioiridium teletherapy. *Acta radiol.*, 1950, *34*, 115–134.

[5] Mitchell, J. S. Practical aspects of radioactive isotopes in relation to medical treatment. *Brit. M. J.*, 1951, *2*, 747–757.

[6] Merewether, Hazel, Osborn, S. B., and Wyard, S. J. Installation of Co^{60} in gamma ray beam unit. *Acta radiol.*, 1952, *37*, 459–468.

[7] Lidén, K. A 10-curie Co^{60} telegamma unit. *Acta radiol.*, 1952, *38*, 139–142.

[8] Johns, H. E. Physical characteristics of radiation in cobalt^{60} beam therapy. *J. Canad. A. Radiologists*, 1952, *3*, 2–6.

[9] Watson, T. A. Clinical possibilities of cobalt^{60} beam unit. *J. Canad. A. Radiologists*, 1952, 3, 7–10.

[10] Dixon, W. R., Garrett, C., and Morrison, A. Room protection measurements for cobalt^{60} teletherapy units. *J. Canad. A. Radiologists*, 1952, *3*, 11–15; also *Nucleonics*, March, 1952, *10*, 42–45; also Radiation measurements with the Eldorado cobalt^{60} teletherapy unit. *Brit. J. Radiol.*, 1952, *25*, 314–318.

[11] Johns, H. E., Epp, E. R., Cormack, D. V., and Fedoruk, S. O. Depth dose data and diaphragm design for Saskatchewan 1000 curie cobalt unit. *Brit. J. Radiol.*, 1952, *25*, 302–308.

[12] Smith, I. H. Cobalt^{60} beam therapy: some influences and advantages. *J. Canad. A. Radiologists*, 1952, *3*, 16–19.

[13] Green, D. T., and Errington, R. F. Considerations in design of cobalt^{60} beam therapy equipment. *J. Canad. A. Radiologists*, 1952, *3*, 20–24; also *Brit. J. Radiol.*, 1952, *25*, 309–313.

very little servicing. The only disadvantage is the need for periodical replenishment of the source (about once every three years), especially since a sufficiently large supply of high specific activity Co^{60} is not yet available. During the past year an additional 1,000 curie unit was completed at Oak Ridge.[3]

Brucer,[3] after reviewing the current status of the production of multicurie sources of gamma radiation, expresses the opinion that besides Co^{60} two other isotopes are "practical" for use in large teletherapy units: Cs^{137} and $Eu^{152-154}$. He believes that radiocesium will become available in large quantities within the next few years (more than 6 per cent of uranium fission products is cesium) and therefore will probably prove the most desirable of the three by a considerable margin. This isotope has a half-life of thirty-three years and emits gamma radiation of 0.66 mev. energy. Extensive study of the combined effects of collimation, specific activity and penumbra led to the conclusion that, as in the cobalt unit, a single large source collimated to produce a single beam is preferable to multiple small sources collimated to converge at the lesion. It is estimated that the size of the equipment necessary for housing a Cs^{137} source will allow a flexibility surpassing even that obtained with the Co^{60} unit and that, therefore, units containing up to 2,000 curies should not be difficult to construct. Radioeuropium has a half-life of 5.35 years and poses from the point of view of design about the same problems as does radiocobalt. According to Brucer,[14] $Eu^{152-154}$ emits gamma radiation 83 per cent of which is of 1 mev. energy and the remainder a mixture of low energies averaging 0.28 mev. This radiation is essentially of the same quality as that obtained from a Co^{60} source. Considering that $Eu^{152-154}$ has a specific activity which is ten to thirty times higher than that of Co^{60}, a europium source could be made considerably smaller than a comparable cobalt source. The main limitation in the use of $Eu^{152-154}$, however, is the insufficient availability of the rare earth metal as target material and the necessity of obtaining it in a very pure state.

It is evident from the foregoing that considerable interest exists at the present time concerning the clinical applicability of teletherapy with various radioactive sources. The Oak Ridge Institute of Nuclear Studies and the Isotope Division of the Atomic Energy Commission, aware of this, jointly sponsored an excellent symposium on teletherapy which was held on December 28, 1951, at Philadelphia, Pennsylvania, as part of the program of the annual meeting of the American Association for the Advancement of Science. The participants—all eminent authorities in their respective fields—discussed a number of important subjects, including the radiotherapist's needs, the physicist's requirements, the availability of radioactive sources, and the proposed types and manufacture of various teletherapy units.[15] Since then the Medical Division of the Oak Ridge Institute of Nuclear Physics, as indicated in its Sixth Annual Report,[16] has established an elaborate teletherapy evaluation program in conjunction with the Institute's sponsoring universities and the regional medical schools. The plan is to build the prototype of a certain teletherapy unit and to submit it to some cooperating medical school for testing. Based on the data obtained, the Teletherapy Evaluation Board will then attempt to delineate the specifications for a standard model. It is stated, however, that despite all efforts the production of any appreciable number of units may not be possible until after 1956.

Clearly, there will be no surprising miraculous effect as far as the biologic action of the gamma rays emitted by any of these units is concerned. Whatever the final

[14] Brucer, Marshall. Evaluation of teletherapy sources. *Nucleonics*, Oct., 1952, *10*, 9.

[15] Papers of the symposium participants are abstracted in the article of Brucer.[3]

[16] Sixth Annual Report of the Oak Ridge Institute of Nuclear Studies. June 30, 1952. Oak Ridge, Tennessee.

choice may be, each unit in its simplest form will perform the function of a roentgen apparatus of an equivalent energy, ranging from 800 kv. for the radioiridium to 3.5 mev. for the radiocobalt. However, since the complex problems of electrical energization, tube control and daily dose calibrations will be eliminated, there is reason to believe that several types of these gamma teletherapy units will find wide usefulness in the not too distant future.

T. Leucutia, M.D.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

MEETINGS OF ROENTGEN SOCIETIES*

UNITED STATES OF AMERICA

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. Barton R. Young, Germantown Hospital, Philadelphia 44, Pa. Annual meeting: Netherland Plaza Hotel, Cincinnati, Ohio, Sept. 29–Oct. 2, 1953.

AMERICAN RADIUM SOCIETY
Secretary, Dr. J. E. Wirth, 635 Herkimer St., Pasadena 1, Calif. Annual meeting: Chase Hotel, St. Louis, Mo., April 19–22, 1953.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. D. S. Childs, 713 E. Genesee St., Syracuse 2, N. Y. Annual meeting: 1953, to be announced.

AMERICAN COLLEGE OF RADIOLOGY
Executive Secretary, William C. Stronach, 20 N. Wacker Drive, Chicago 6, Illinois.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. T. Leucutia, Harper Hospital, Detroit 1, Mich. Annual meeting: 1953, to be announced.

ALABAMA RADIOLOGICAL SOCIETY
Secretary, Dr. J. A. Meadows, Jr., Medical Arts Bldg., Birmingham 5, Ala. Meets time and place Alabama State Medical Association.

ARIZONA RADIOLOGICAL SOCIETY
Secretary, Dr. R. Lee Foster, 15 E. Monroe, Phoenix, Ariz. Two regular meetings a year. The annual meeting at time and place of State Medical Association and interim meeting six months later.

ARKANSAS RADIOLOGICAL SOCIETY
Secretary, Dr. Fred Hames, 511 National Bldg., Pine Bluff, Ark. Meets every three months and also at time and place of State Medical Association.

ATLANTA RADIOLOGICAL SOCIETY
Secretary, Dr. Albert A. Rayle, Jr., 478 Peachtree St., N.E., Atlanta, Ga. Meets monthly, except during three summer months, on second Friday evening.

BROOKLYN ROENTGEN RAY SOCIETY
Secretary, Dr. J. J. Daversa, 345 75th St., Brooklyn, N. Y. Meets monthly fourth Tuesday, October through April.

BUFFALO RADIOLOGICAL SOCIETY
Secretary, Dr. Mario C. Gian, 610 Niagara St., Buffalo, N. Y. Meets second Monday evening each month, October to May inclusive.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. Dwight V. Needham, 608 E. Genesee St., Syracuse N. Y. Meets January, May, November.

CENTRAL OHIO RADIOLOGICAL SOCIETY
Secretary, Dr. F. A. Riebel, 15 West Goodale St., Columbus, Ohio. Meets at 6:30 P.M. on second Thursday of October, December, February, April, and June at Columbus Athletic Club, Columbus, Ohio.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. Elbert K. Lewis, 6337 S. Harvard Ave., Chicago, Ill. Meets second Thursday of each month, October to April inclusive at the University Club.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. Mortimer Lubert, 10515 Carnegie Ave., Cleveland 6, Ohio. Meetings at 6:45 P.M. on fourth Monday of each month from October to April.

COLORADO RADIOLOGICAL SOCIETY
Secretary, Dr. William Curtis, 1612 Tremont, Denver, Colo. Meets third Friday of each month at University of Colorado Medical Center or at Denver Athletic Club.

CONNECTICUT VALLEY RADIOLOGIC SOCIETY
Secretary, Dr. E. W. Godfrey, 1676 Boulevard, West Hartford, Conn. Meets second Friday October and April.

DALLAS-FORT WORTH ROENTGEN STUDY CLUB
Secretary, Dr. X. R. Hyde, Medical Arts Bldg., Fort Worth, Texas. Meets in Dallas on odd months and in Fort Worth on even months, on third Monday, 7:30 P.M.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. J. C. Cook, Harper Hospital, Detroit, Mich. Meets monthly first Thursday, October to May, at Wayne County Medical Society Building.

EAST BAY ROENTGEN SOCIETY
Secretary, Dr. Dan Tucker, 434 30th St., Oakland 9, Calif. Meets first Thursday each month at Peralta Hospital, Oakland.

FLORIDA RADIOLOGICAL SOCIETY
Secretary, Dr. A. Judson Graves, 2002 Park St., Jacksonville, Fla. Meets twice annually, in the spring with the annual State Society meeting, and in the fall.

GEORGIA RADIOLOGICAL SOCIETY
Secretary, Dr. Robert M. Tankesley, 218 Doctors Bldg., Atlanta, Ga. Meets in mid-winter and at annual meeting of Medical Association of Georgia in the spring.

GREATER MIAMI RADIOLOGICAL SOCIETY
Secretary, Dr. Maurice Greenfield, Ingraham Bldg., Miami, Fla. Meets third Wednesday of each month at Veterans Administration Building.

HOUSTON RADIOLOGICAL SOCIETY
Secretary, Dr. F. M. Windrow, 1205 Hermann Professional Bldg., Houston, Texas. Meets fourth Monday each month.

IDAHO STATE RADIOLOGICAL SOCIETY
Secretary, Dr. Alfred M. Stone, St. Lukes Hospital, Boise, Idaho. Meets annually at same time as Idaho State Medical Association.

ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. Stephen L. Casper, 1101 Maine St., Quincy, Ill. Meets three times a year.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. William M. Loehr, 712 Hume-Mansur Bldg., Indianapolis 4. Meets second Sunday in May.

IOWA X-RAY CLUB
Secretary, Dr. James McMillan, 1104 Bankers Trust Bldg., Des Moines, Iowa. Luncheon and business meeting during annual session of Iowa State Medical Society. The scientific section is held in the autumn.

KANSAS RADIOLOGICAL SOCIETY
Secretary, Dr. Willis L. Beeler, M.D., 700 Kansas Ave., Topeka, Kansas. Meets in spring with State Medical Society, and in winter on call.

KENTUCKY RADIOLOGICAL SOCIETY
Secretary, Dr. E. L. Pirkey, Louisville General Hospital, Louisville 2, Ky. Meets monthly on second Friday at Seelbach Hotel, Louisville.

KINGS COUNTY RADIOLOGICAL SOCIETY
Secretary, Dr. Marcus Wiener, 1430 48th St., Brooklyn, N. Y. Meets Kings County Med. Soc. Bldg. monthly on fourth Thursday, October to May, 8:45 P.M.

LOS ANGELES RADIOLOGICAL SOCIETY
Secretary, Dr. Joseph F. Linsman, 436 N. Roxbury Dr., Beverly Hills, Calif. Meets second Wednesday each month at Los Angeles County Medical Association Building, Los Angeles.

LOUISIANA RADIOLOGICAL SOCIETY
Secretary, Dr. J. R. Anderson, 1130 Louisiana Ave., Shreveport. Meets annually during Louisiana State Medical Society Meeting.

* Secretaries of societies are requested to send timely information promptly to the Editor.

Maine Radiological Society
Secretary, Dr. Hugh Allan Smith, Eastern Maine General Hospital, Bangor, Maine. Meets in early spring, June and fall.

Miami Valley Radiological Society
Secretary, Dr. G. A. Nicoll, 134 Apple St., Dayton, Ohio. Meets second Friday of fall and winter months.

Mid-Hudson Radiological Society
Secretary, Dr. J. W. Walton, Horton Memorial Hospital, Middletown, N. Y. Meets 8:30 P.M., fourth Tuesday each month, September to May.

Milwaukee Roentgen Ray Society
Secretary, Dr. T. J. Pfeffer, 839 N. Marshall St., Milwaukee 2, Wis. Meets monthly on second Monday at University Club.

Minnesota Radiological Society
Secretary, Dr. John R. Hodgson, Mayo Clinic, Rochester, Minn. Meets three times annually, once at time of State Med. Assn., and in spring and fall.

Mississippi Radiological Society
Secretary, Dr. John W. Evans, 621 High Street, Jackson 2, Miss. Meets third Thursday of each month at the Rotisserie Restaurant at 6:30 P.M.

Montana Radiological Society
Secretary, Dr. Grant P. Raitt, Suite 413 Medical Arts Bldg., Billings, Montana. Will meet at least once a year.

Nassau Radiological Society
Secretary, Dr. Joseph J. La Vine, 259 North Grand Ave., Baldwin, N. Y. Meets second Tuesday of the month in February, April, June, October and December.

Nebraska Radiological Society
Secretary, Dr. R. W. Blanchard, 1216 Medical Arts Bldg., Omaha, Nebr. Meets fourth Thursday of each month at 6 P.M. at Omaha or Lincoln.

New England Roentgen Ray Society
Secretary, Dr. Stanley M. Wyman, Massachusetts General Hospital, Boston, Mass. Meets monthly on third Friday, Harvard Club.

New Hampshire Roentgen Ray Society
Secretary, Dr. A. C. Johnston, Elliott Community Hospital, Keene, N. H. Meets four to six times yearly.

New York Roentgen Society
Secretary, Dr. Harold W. Jacox, 622 W. 168th St., New York 32, N. Y. Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

North Carolina Radiological Society
Secretary, Dr. J. E. Hemphill, 1420 E. Fifth St., Charlotte 4, N. C. Meets in May and October.

North Dakota Radiological Society
Secretary, Dr. C. O. Heilman, 807 Broadway, Fargo. Meetings by announcement.

Northeastern New York Radiological Society
Secretary, Dr. John F. Roach, Albany Hospital, Albany, N. Y. Meets in Albany area on second Wednesdays of October, November, March and April. Annual meeting will be held in May or June, 1953.

Northern California Radiological Society
Secretary, Dr. Richard C. Ripple, 1215 28th Street, Sacramento, Calif. Meets at dinner last Monday of September, November, January, March and May.

Ohio State Radiological Society
Secretary, Dr. Willis S. Peck, 1838 Parkwood Ave., Toledo 2, Ohio.

Oklahoma State Radiological Society
Secretary, Dr. John R. Danstrom, Medical Arts Bldg., Oklahoma City, Okla. Three regular meetings annually.

Oregon Radiological Society
Secretary, Dr. J. Richard Raines, 214 Medical-Dental Bldg., Portland 5, Oregon. Meets monthly from October to June on the second Wednesday of each month at 8:00 P.M. at the University Club.

Orleans Parish Radiological Society
Secretary, Dr. Joseph V. Schlosser, Charity Hospital, New Orleans 13, La. Meets first Tuesday of each month.

Pacific Northwest Radiological Society
Secretary, Dr. S. J. Hawley, 1320 Madison St., Seattle 4, Wash. Meets annually in May.

Pacific Roentgen Society
Secretary, Dr. L. H. Garland, 450 Sutter St., San Francisco, Calif. Meets annually, during meeting of California Medical Association.

Pennsylvania Radiological Society
Secretary, Dr. J. M. Converse 416 Pine St., Williamsport.

Philadelphia Roentgen Ray Society
Secretary, Dr. George P. Keefer, American Oncologic Hospital, Philadelphia 4, Pa. Meets first Thursday of each month, at 5 P.M., from October to May in Thompson Hall, College of Physicians.

Pittsburgh Roentgen Society
Secretary, Dr. Donald H. Rice, Western Pennsylvania Hospital, Pittsburgh 24, Pa. Meets 6:00 P.M. at Webster Hall Hotel on second Wednesday each month, October to May inclusive.

Radiological Section, Baltimore Medical Society
Secretary, Dr. H. Leonard Warres, 2337 Eutaw Place, Baltimore 17, Md. Meets third Tuesday each month, September to May, inclusive.

Radiological Section, Connecticut Medical Society
Secretary, Dr. William A. Goodrich, 85 Jefferson St., Hartford 6, Conn. Meetings are held bi-monthly.

Radiological Section, Medical Society of the District of Columbia
Secretary, Dr. U. V. Wilcox, 915 Nineteenth St., N. W., Washington 6, D. C. Meets Medical Society Library, third Thursday of January, March, May and October at 8:00 P.M.

Radiological Section, Southern Medical Association
Secretary, Dr Roy G. Giles, Temple, Texas.

Radiological Society of Greater Cincinnati
Secretary, Dr. Harry K. Hines, 2508 Auburn Ave., Cincinnati 19, Ohio. Meets monthly from September to June on first Monday of each month at 7:30 P.M. at the Cincinnati General Hospital.

Radiological Society of Hawaii
Secretary, Colonel Alexander O. Haff, M.C., Tripler Army Hospital, Honolulu, T. H. Meets third Friday of each month at Tripler Army Hospital.

Radiological Society of Kansas City
Secretary, Dr. Arthur B. Smith, 800 Argyle Bldg., Kansas City, Mo. Meets third Thursday of each month.

Radiological Society of New Jersey
Secretary, Dr. Nicholas G. Demy, 912 Park Avenue, Plainfield, N. J. Meets annually at Atlantic City at time of State Medical Society and mid-winter at Elizabeth, N. J.

Richmond County Radiological Society
Secretary, Dr. W. F. Hamilton, Jr., University Hospital, Augusta, Ga.

Rochester Roentgen Ray Society, Rochester, N. Y.
Secretary, Dr. Robert J. Bloor, 260 Crittenden Blvd., Rochester, N. Y. Meets last Monday of each month, September through May, at Strong Memorial Hospital.

Rocky Mountain Radiological Society
Secretary, Dr. Maurice D. Frazer, 1037 Stuart Bldg., Lincoln, Nebr. Next annual meeting, Shirley-Savoy Hotel, Denver, Colo., August 20, 21 and 22, 1953.

St. Louis Society of Radiologists
Secretary, Dr. Francis O. Trotter, Jr., 634 N. Grand Blvd., St. Louis 3, Mo. Meets fourth Wednesday each month, except June, July, August and September.

San Antonio-Military Radiological Society
Secretary, Dr. Hugo F. Elmendorf, Jr., 730 Medical Arts Bldg., San Antonio 5, Texas. Meets Brook Army Medical Center Officers Mess first Monday of each month.

San Diego Radiological Society
Secretary, Dr. Rex Uncapher, 7720 Girard Ave., La Jolla, Calif. Meets first Wednesday of each month at the University Club.

San Francisco Radiological Society
Secretary, Dr. I. J. Miller, 2680 Ocean Avenue, San Francisco 27, Calif. Meets quarterly.

Section on Radiology, California Medical Association
Secretary, Dr. Calvin L. Stewart, 2330 First Ave., San Diego 1, Calif.

Section on Radiology, Illinois State Medical Society
Secretary, Dr. George E. Irwin, Jr., 703 N. East St., Bloomington, Ill.

Shreveport Radiological Club
Secretary, Dr. R. W. Cooper, Charity Hospital, Shreveport, La. Meets monthly on third Wednesday, at 7:30 P.M., September to May inclusive.

South Bay Radiological Society
Secretary, Dr. Ford Shepherd, 526 Soquel Avenue, Santa Cruz, Calif. Meets second Wednesday each month.

South Carolina Radiological Society
Secretary, Dr. Henry E. Plenge, Spartanburg General Hospital, Spartanburg, S. C. One meeting with South Carolina Medical Association in May, others arranged by President.

Tennessee Radiological Society
Secretary, Dr. J. M. Frère, Newell Hospital, Chattanooga, Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

Texas Radiological Society
Secretary, Dr. R. P. O'Bannon, 650 Fifth Ave., Fort Worth 4, Texas. Next meeting: San Antonio, Texas, January 23 and 24, 1953.

University of Michigan Department of Roentgenology Staff Meeting
Meets each Monday evening from September to June, at 7:00 P.M. at University Hospital.

University of Wisconsin Radiological Conference
Secretary, Dr. E. A. Pohle, 1300 University Ave., Madison, Wis. Meets first and third Thursdays 4:00 to 5:00 P.M., September to May, Service Memorial Institute.

Utah State Radiological Society
Secretary, Dr. Angus K. Wilson, 343 S. Main St., Salt Lake City 1, Utah. Meets third Wednesday in September, November, January, March and May.

Virginia Radiological Society
Secretary, Dr. P. B. Parsons, Norfolk General Hospital, Norfolk, Va. Meets annually in October.

Washington State Radiological Society
Secretary, Dr. John N. Burkey, 555 Medical-Dental Bldg., Seattle 1, Wash. Meets fourth Monday of each month from September through May.

Westchester Radiological Society
Secretary, Dr. Walter J. Brown, Northern Westchester Hospital, Mt. Kisco, N. Y. Meets on third Tuesdays of January and October and on two other dates.

Wisconsin Radiological Society
Secretary, Dr. Irving I. Cowan, 425 E. Wisconsin Ave., Milwaukee 2, Wis. Special meetings held during year; annual meeting each spring at Madison, Wis.

X-Ray Study Club of San Francisco
Secretary, Dr. Charles E. Duisenberg, Palo Alto Clinic, 300 Homer Ave., Palo Alto, Calif. Meets third Thursday at 7:45 P.M., January to June, Lane Hall, Stanford University Hospital; July to December, San Francisco Hospital.

Cuba, Mexico and Central America

Sociedad de Radiología y Fisioterapia de Cuba
President, Dr. J. Manuel Viamonte, Hospital Mercedes, Habana, Cuba. Meets monthly in Habana.

Sociedad Mexicana de Radiologia y Fisioterapia
General Secretary, Dr. D. P. Cossio, Marsella No. 11, Mexico, D. F. Meets first Monday of each month.

Sociedad Radiológica Panameña
Secretary, Dr. L. Arrieta Sanchez, Apartado No. 86, Panama, R. de P. Meets monthly in a department of radiology of a local hospital, chosen at preceding meeting.

British Empire

British Institute of Radiology Incorporated with the Röntgen Society
Ordinary meeting, on the Thursday preceding the third Friday, October to May at 8:15 P.M.
Medical Members' meeting, on third Friday in each month at 5:00 P.M., 32 Welbeck St., London, W 1.

Faculty of Radiologists
Honorary Secretary, Dr. J. F. Bromley, 45, Lincoln's Inn Fields, London, W.C.2, England.

Section of Radiology of the Royal Society of Medicine (Confined to Medical Members)
Meets third Friday each month at 4:45 P.M. at the Royal Society of Medicine, 1 Wimpole St., London.

Canadian Association of Radiologists
Honorary Secretary-Treasurer, Dr. Jean Bouchard, Suite 305, 1555 Summerhill Avenue, Montreal 26, Que. Meetings January and June.

Section of Radiology, Canadian Medical Association
Secretary, Dr. C. M. Jones, Inglis St., Ext. Halifax, N. S.

Société Canadienne-Française d'Electrologie et de Radiologie Médicales
Secretary, Dr. Origéne Dufresne, 4120 Ontario St., East, Montreal, P. Q.

College of Radiologists (Australia and New Zealand)
Honorary Secretary, Dr. Alan R. Colwell, c/o British Medical Agency, 135 Macquarie St., Sydney, N.S.W.

South America

Asociacion Argentina de Radiologia
Secretary, Dr. Lidio G. Mocsa, Avda. Gral. Paz 151, Córdoba, Argentina. Meetings held monthly.

Sociedad Argentina de Radiologia, Junta Central, Buenos Aires
Secretary, Dr. Oscar F. Noguera, Santa Fe 1171, Buenos Aires. Meetings are held monthly.

Sociedad Argentina de Radiologia, Filial del Litoral, Sede, Rosario
President, Dr. Francisco P. Cifarelli. Meets monthly second Wednesday, 19 ha 663 Italia St., Rosario, Santa Fe.

Sociedad Argentina de Radiologia, Filial del Sur, Sede, La Plata
President, Prof. Dr. Jose P. Uslenghi, La Plata. Meets monthly.

Sociedad Argentina de Radiologia, Filial del Centro Sede, Cordoba
President, Prof. Dr. David L. Caro, Corro 86, Cordoba. Meets monthly.

Sociedad Argentina de Radiologia, Filial del Norte, Sede, Tucuman
President, Dr. Julio Mendez Valladares, Rivadavia 358, Tucuman. Meets monthly.

Sociedad Argentina de Radiologia, Filial de Cuyo Sede, Mendoza.
President, Dr. J. A. Orfila, Hospital Central, Mendoza. Meets monthly.

Sociedade Brasileira de Radiologia Medica
Secretary, Dr. Nicola Caminha, Av. Mem de Sa, Rio de Janeiro, Brazil. Meets monthly, except during January, February and March.

Sociedade Brasileira de Radioterapia
Secretary, Dr. Oscar Rocha von Pfuhl, Av. Brigadeiro Luiz Antonio, 644 São Paulo, Brazil. Meets monthly on second Wednesday at 9:00 P.M. in São Paulo at Av. Brigadeiro Luiz Antonio, 644.

Sociedad Colombiana de Radiologia
Secretary, Dr. Alberto Torres Focke, Av. 34, No. 17–34, Bogota, Colombia. Meets last Wednesday of each month.

Sociedad Peruana de Radiologia
Secretary, Dr. Julio Bedoya Paredes, Apartado 2306, Lima, Peru. Meets monthly except during January, February and March, at Asociación Médica Peruana "Daniel A. Carrión," Villalta, 218, Lima.

Sociedad de Radiologica, Cancerologia y Fisica Medica del Uruguay
Secretary, Dr. Arias Bellini, Av. Agraciada 1464, Piso 13, Montevideo, Uruguay.

Continental Europe

Société Belge de Radiologie
General Secretary, Dr. S. Masy, 111 Avenue des Allies, Louvain, Belgium. Meets monthly, second Sunday at Maison des Médecins, Brussels.

Société Française d'Electro-Radiologie Médicale, and its branches: Société du Sud-Ouest, du Littoral Méditerranéen, du Centre et du Lyonnais, de l'Ouest, de l'Est, et d'Alger et d'Afrique du Nord
Secretary-General, Dr. A. Dariaux, 9 bis, Boulevard Rochechouart, Paris IX^e^, France.

Ceskoslovensk společnost pro rëntgenologii a Radiologii v Praze
Secretary, Dr. Roman Bláha, Praha XII, stát. nemocnice, Czechoslovakia. Meets monthly except during July, August, and September. Annual general meeting.

Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland.

Gdansk Section, Polish Society of Radiology
Secretary, Dr. A. Smigielska, Akademia Lekarska, Gdansk. Meets monthly last Sunday at 10:30, X-Ray Dept., Akademia Gdansk.

Wrocław Section Polish Society of Radiology
Secretary, Dr. R. Marciniak, Akad. Medyczna Wrocław, 68 Curie-Skłodowska St., Wrocław, Poland. Meets first Sunday of each month, X-Ray Department, Akademia Medyczna Wrocław.

Societatea Romana de Radiologie si Electrologie
Secretary, Dr. Oscar Meller, Str. Banual Mărăcine, 30, S. I., Bucuresti, Roumania. Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad
USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson. Meets annually.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association.

Sociedad Espanola de Radiologia y Electrologia
Secretary, Dr. J. Martin-Crespo, Fuencarral, 7. Madrid, Spain. Meets monthly in Madrid.

Schweizerische Röntgen-Gesellschaft (Société Suisse de Radiologie)
Secretary, Dr. Max Hopf, Effingerstrasse 47, Bern, Switzerland.

Deutsche Roentgen-Gesellschaft
Secretary, Dr. Peter Kröker, (22a) Essen-Helsingen, Westpreussenstrasse 21. Meets annually in different towns.

Societa Italiana dr Radiologia Medica
Secretary, Prof. Mario Ponzio, Ospedale Mauriziano. Torino, Italy. Meets biannually.

India

Indian Radiological Association
Secretary, Dr. R. F. Sethna, Navsari Building, Hornby Road, Bombay 1, India.

DAVID ANDERSON-BERRY PRIZE (1953)

This is a second notice that a David Anderson-Berry Silver-Gilt Medal, together with a sum of money amounting to about £100, will be awarded during 1953 by the Royal Society of Edinburgh to the person, who, in the opinion of the Council, has recently produced the best work on the therapeutic effect of roentgen radiation on human diseases. Applications for this prize are invited. They may be based on both published and unpublished work and should be accompanied by copies of the relevant papers. Applications must be in the hands of the General Secretary, Royal Society of Edinburgh, 22 George Street, Edinburgh, 2, *not later than March 31, 1953.*

LOS ANGELES RADIOLOGICAL SOCIETY

At the annual election of the Los Angeles Radiological Society in November, 1952, the following officers were elected for the coming year: *President*, Dr. John B. Hamilton; *Vice-President*, Dr. Walter L. Stilson; *Secretary*, Dr. Joseph F. Linsman; *Treasurer*, Dr. M. M. Haskell.

MONTANA RADIOLOGICAL SOCIETY

The Radiologists of Montana met at Missoula, Montana, on September 19, 1952, and organized the Montana Radiological Society. Dr. Walter Cox was elected President and Dr. Grant P. Raitt, Secretary of the new organization. It was suggested that the constitution and by-laws of the American College of Radiology be adopted. The new society will have at least one meeting a year.

BOOK REVIEWS

Books sent for review are acknowledged under: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interest of our readers as space permits.

MICRO-ARTERIOGRAPHY. AND OTHER RADIOLOGICAL TECHNIQUES EMPLOYED IN BIOLOGICAL RESEARCH. By Alfred E. Barclay, O.B.E., M.D., D.Sc. (Hon.) Oxon., D.Sc. (Hon.) Manchester, F.R.C.P., F.F.R., F.A.C.R., Honorary Radiologist to the Nuffield Institute for Medical Research, Oxford. Cloth. Price, $6.75. Pp. 102, with 46 illustrations. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1951.

The author was urged, in his final illness, to record the radiological techniques which he had developed for cardiovascular research. He undertook it despite his illness, stating in the Preface, ". . . it was evident that it was a case of now or never, for the dice were loaded against me both as regards time and energy." The inspiration to complete the book is perhaps best expressed in his own words, "To help those who take up the work is my one and only object."

The work describes in detail the two outstanding contributions of this great man, namely cineradiography and microarteriography. In the introduction he stresses the fact that roentgen rays have been greatly overlooked as an investigative weapon and urges the use of the radiological approach in research. By this he means the application of radiological methods, ". . . not as mere accessory techniques but as the first line of attack, the spearhead with which to pierce towards the heart of the biological problems."

The evolution of the techniques is described in the first chapter. In the investigation of the crush syndrome, a team of research workers was formed. This included a physiologist, a clinician, a pathologist, and Dr. Barclay as the radiologist. Cineradiography and stereoscopic roentgenograms were used but were excelled by other histological techniques at first, particularly for the study of smaller structures. The development of microarteriography, however, supplied the radiological tool which surpassed the other methods, particularly in the study of the vascular system.

A chapter is devoted to research apparatus and protection.

Cineradiography was developed to provide a method of taking a series of roentgenograms in rapid succession. This technique was first demonstrated in 1897 by MacIntyre of Glasgow using the direct method by which a series of roentgenograms were taken in rapid sequence. The indirect method of photographing the fluorescent screen was developed later. Barclay used both the direct and indirect methods in the study of the fetal circulation and describes the details of these methods.

The technique of microarteriography is considered by Barclay to be the more important section of the book, and accordingly more space is devoted to the description of this technique. The discussion includes photographic emulsions, the generator, mounting the roentgen tube, cassettes, the dark room, sectioning, mounting the specimen, exposure, target distances, processing, and enlargement. Each procedure is described in detail and this chapter is extremely valuable to anyone undertaking this technique. The illustrations of the microarteriographs are exceptional and several unusual ones of the kidney are included on folded sheets. The applications of microarteriography is discussed and in this chapter illustrations of the microscopic circulation of several other organs are shown.

A short but very complete and informative chapter on the selection and injection of contrast media by R. G. Harrison is included. Those who are interested in microradiography will find this book a most helpful guide.

A rather unusual epilogue completes the book. In this the author characteristically pays tribute to clinicians, and in particular to his coworker, Professor Trueta.

The book is well written in a style which reflects the keen mind and perception of one of the great radiologists of our time.

WALLACE S. TIRMAN, M.D.

AN ATLAS OF NORMAL RADIOGRAPHIC ANATOMY. By Isadore Meschan, M.A., M.D., Professor and Head of the Department of Radiology, University of Arkansas School of Medicine. With the assistance of R. M. F. Farrer-Meschan, M.B., B.S., (Melbourne,

Australia). Cloth. Price, $15.00. Pp. 593, with 362 illustrations. W. B. Saunders Company, West Washington Square, Philadelphia, Pennsylvania, 1951.

The authors state in their preface that this book was undertaken in an effort to fulfill some of the needs of teachers of morbid anatomy, teachers of radiology, teachers of clinical medicine, and general practitioners who have needed a ready guide and reference for their everyday problems and for more intelligent consultation with the specialist in radiology. They have attempted to make convenient for the student a single compendium of normal roentgenographic anatomy which includes: (1) basic morbid anatomy as it is applicable to roentgenology; (2) the manner in which the routine projections employed in roentgenology are obtained; (3) a concept of the film so obtained; (4) the anatomic parts best visualized on these views; (5) changes with growth and development; and (6) some of the more common variations of normal. In view of the fact that any one of these objectives, as the authors state, could in itself occupy an entire text, they have succeeded in a creditable manner.

The book consists of 16 chapters. Reproductions of roentgenograms of individual anatomical structures, line drawings indicating anatomical points with relationship to contiguous structures, and illustrations of positioning of patients, are used to supplement the text. In the first chapter the fundamental background for roentgenological anatomy is discussed. In the second chapter the development of bone, macroscopic view of bone, microscopy of bone, and general principles of importance in the roentgenological anatomy of the skeletal system are described in nine pages. Then follow chapters on the regional anatomy of the skeletal system using the method above mentioned. Following the skeletal system are chapters on the brain, vertebral column and subarachnoid space, the respiratory system, the mediastinum, special studies on the heart and major blood vessels, the gastrointestinal tract, abdomen and peritoneal space, the urinary tract and the genital system.

The book is not of the large, usual atlas size which necessitates comparatively small drawings of anatomical parts with resultant rather close lettering of the various anatomical points. This, however, is a minor consideration when the book is viewed as a whole. The illustrations are otherwise clear and excellent. The fundamental and necessary positions for roentgenological examinations are included. Newer methods of examination also have not been neglected. The book will prove to be a very useful volume for roentgenologists, students and technicians.

RALPH S. BROMER, M.D.

THE SKULL AND BRAIN ROENTGENOLOGICALLY CONSIDERED. By C. Wadsworth Schwartz, Ph.B., M.D., F.A.C.R., Associate Professor of Clinical Radiology, College of Physicians and Surgeons, Columbia University, etc.; and Lois Cowan Collins, B.S., M.D., Associate Professor of Radiology, College of Physicians and Surgeons, Columbia University, etc. Cloth. Price, $10.50. Pp. 386, with 335 illustrations. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1951.

To be valuable as a text for ready reference, a book must be well organized, so that material can be found easily; to be of practical usefulness in radiology, it must present numerous well reproduced typical illustrations. This volume is designed to fulfill both qualifications.

The written material is arranged simply and directly. Following chapters on techniuqe of examination, normal appearances and variants, congenital anomalies, and traumatic disorders, there are several chapters on neoplastic diseases. The discussion of tumors occupies almost one-half of the volume. The diagnostic criteria of plain roentgenograms are stressed, and the use of contrast media is not discussed. There are also chapters on infectious diseases and on a large number of miscellaneous diseases.

Throughout the volume the primary aim appears to be an attempt to aid in interpretation of roentgenograms in a practical manner. The clinical aspects of each lesion are referred to briefly and emphasis is placed on differentiation of abnormalities which have similar roentgen appearances. The authors state that no attempt has been made to produce an exhaustive work, but it is a tribute to their writing ability that so much material has been well covered with such economy of text material. Of particular value are the chapters on intracranial neoplasms, as these differentiate the various types of intracranial calcification. An important addition is an adequate bibliography at the end of each chapter for those who wish a more complete treatment of some specific point.

In 370 pages of text there are 365 excellent illustrations, most of which occupy about one-half of each page. The quality of the reproductions is excellent, and the cases illustrate characteristic changes. In this respect the volume is an atlas of skull diagnosis, and is meant to be kept close at hand for use during interpretation of films. It is primarily a practical book for the practical radiologist and should thus find wide usefulness as the first book to be consulted when a problem roentgenogram of the skull is encountered.

E. F. Lang, M.D.

Medizinische Röntgentechnik. I. Medizinischer Teil: Skelettaufnahmen und Organuntersuchungen. Von Prof. Dr. Herbert Schoen, Karlsruhe. Cloth. Price, DM 22.50. Pp. 228, with 476 illustrations. Georg Thieme, Diermershaldenstrasse, 47, Stuttgart, Germany, 1951.

Written primarily for medical technicians, this book serves as a valuable guide in positioning patients for routine views and contains useful suggestions for taking unusual views of more difficult regions. Each part of the body is exemplified by a photograph of the patient and tube in proper position, a photograph of the anatomical specimen with clear designation of the points of interest, and the corresponding roentgenogram. The group of three illustrations appears on the same page accompanied by a routine roentgenographic technique containing detailed explanatory notes.

The author has devised a "bridge" for special views of the shoulder, elbow, wrist, knee, and so forth. A short but satisfactory description of specialized procedures, such as arthrography, arteriography, encephalography, foreign body localization, and so forth, is included.

Technicians, students, and experienced radiologists will wish to own a copy of this book even if they do not read German, since the excellent illustrations overcome any language difficulty.

J. Zausner, M.D.

Die Dystrophie. By Professor Dr. med. Heinrich Berning, Oberarzt der I. Med. Universitätsklinik, Hamburg-Eppendorf (Direktor Prof. H. H. Berg). Cardboard. Price, DM 18.–. Pp. 197, with 34 illustrations and 15 tables. Georg Thieme, Diemershaldenstrasse, 47, Stuttgart, Germany (Grune & Stratton, Inc., New York, New York), 1949.

The title of this book is somewhat misleading. As defined by Berning, dystrophy is synonymous with the manifestations of malnutrition and hunger. The work is based upon the author's experience in Germany with a great number of patients suffering from severe malnutrition following the First, and during and after the Second World War.

The history of this condition, its disposition, morbidity and mortality as well as the clinical symptomatology are adequately dealt with. The author distinguishes two types of "dystrophy"—one a dry, atrophic form and the other an edematous type.

The clinical changes in the intestinal tract, the circulatory system, the nervous system, the inner secretions, and body metabolism, normal and abnormal, are presented in considerable detail. Avitaminosis and changes in the peripheral blood stream and in the bone marrow are mentioned. There follow discussions of differential diagnosis, prognosis, and suggestions for curative and prophylactic therapy.

This book will hold a very limited interest for the radiologist since the roentgenologic aspects of the condition are mentioned only in connection with changes in the gastrointestinal tract and the heart. In these cases, the heart has been noted as being relatively small. Survey roentgenograms of the abdomen have shown considerable distention of the small and large intestine. On contrast studies of the colon, a marked atony, particularly in the descending, sigmoid, and rectal portions, was a constant observation. Unusually large amounts of barium were required for a barium enema, the appearance being that of megacolon, and a point of diagnostic importance is the patient's inability to evacuate completely, a large amount of barium being retained within the colon. Moderate edema of the mucosa was frequently seen, especially in the edematous type of dystrophy. This resembled that seen in ulcerative colitis, although ulceration was never apparent.

Fortunately, the conditions described by Berning are rarely seen in this country. The book, therefore, will offer little but academic interest to either the radiologist or clinician practicing at home. It is recommended, however, to those whom the Military or Public Health Service may call to regions less happily situated,—where hunger and malnutrition are prevalent.

H. Peter Mueller, M.D.

LE ZONE POLMONARI. ANATOMIA E MORFOGENESI. By G. Lambertini and D. Catalano. Paper. Pp. 134, with 60 illustrations. Libreria Scientifica Editrice, Corso Umberto 1, 40, Napoli, Italia, 1950.

This book represents a very detailed study of the embryology, development and anatomy of the lungs. The authors have studied the subject by means of celluloid casts of the bronchi, by means of arterial and venous injections followed by roentgenograms, and by microscopic sections. Their work indicates the segmental division of the lungs and describes the separate vascular lymphatic bronchial and nervous supply of each segment. The book is well written and has numerous, excellent illustrations.

CESARE GIANTURCO, M.D.

EFFECTS OF EXTERNAL BETA RADIATION. National Nuclear Energy Series, Manhattan Project Technical Section. Division IV—Plutonium Project Record, Volume 22 E. Edited by Raymond E. Zirkle, Professor of Radiobiology, Institute of Radiobiology and Biophysics, University of Chicago, etc. First edition. Cloth. Price, $3.25. Pp. 242, with numerous illustrations and tables. McGraw-Hill Book Company, 330 West 42nd Street, New York 18, New York, 1951.

The work reported in this book was part of an intensive radiobiology program carried out from September, 1942 through 1945 at the Clinton Laboratories, Oak Ridge, Tennessee, under the supervision of Dr. Howard J. Curtis. The authors' objective was to determine the biological effects of beta rays on animals and extrapolation of this data to humans. This well organized volume creates the foundation of an entire field of study. The first chapter by J. R. Raper, R. E. Zirkle and K. K. Barnes deals with the techniques of external irradiation with beta rays. These authors have developed radiation sources with the newly built chain reacting pile. They have also done considerable work on dosimetry. This excellent work was the basis for the quantitative observations for the subsequent work described in the book. The remaining chapters deal with various biological effects.

A good deal of the experimental work was done by J. R. Raper with the collaboration of K. K. Barnes, E. A. Barnes, J. E. Wirth, P. S. Henshaw, R. S. Snider, and the editor, Raymond E. Zirkle, whose function had much to do with the design and planning of all the experiments. The volume describes gross effects of partial and total surface beta irradiation of various animals, defines the relationship between the size of the animal and the lethal effect of total surface beta radiation, studies the relationship and additivity of beta and gamma irradiation on the animal body, and compares the effects of beta radiation with other external radiation effects. The metabolic pattern of rats irradiated by beta rays, effects on peripheral blood, and histopathological changes after beta irradiation are described. One chapter is devoted to the reactions of human skin to single doses of beta rays. A treatment of delayed effects of exposure to external beta rays, including carcinogenic properties of beta radiation, is given. One chapter deals with aberrant tissue developments of rats exposed to beta rays. The chapters are concisely written and are organized in logical sequence. The reader obtains a firm and comprehensive foundation concerning beta-ray effects on animals. It is regrettable that a few additional chapters were not included to indicate the development of this interesting field since the end of the war. This would have brought the book a little more up to date.

The editor and the authors are to be congratulated for this fine volume which will find its place on the bookshelf of many radiologists and those interested in the fundamental and applied effects of various radiations.

CORNELIUS A. TOBIAS, PH.D.

INDUSTRIAL MEDICINE ON THE PLUTONIUM PROJECT. Survey and Collected Papers. Edited by Robert S. Stone, M.D., Professor of Radiology and Chairman of the Division of Radiology, University of California School of Medicine; formerly Associate Project Director for Health, Metallurgical Project, University of Chicago; Consultant, Argonne National Laboratory. First edition. Cloth. Pp. 511, with numerous illustrations and tables. McGraw-Hill Book Company, 330 West 42nd Street, New York, 18, New York, 1951.

This is a remarkable book on the medical program for industries of the *Plutonium Project.* To evaluate properly the enormous task of caring for the workers as well as searching for methods to overcome serious hazards one should first read the second-last chapter of the book "Status of Health and Protection at the Hanford Engineer Works." This document, the editor explains, "was written for the employees

of the Hanford Engineer Works shortly after the dropping of the atomic bombs on Japan. Many of the workers at the plant had been unaware of the nature of the materials with which they were working; this document was prepared to reassure them concerning their safety on the job and to emphasize the fact that great care had been taken to safeguard their welfare." One may well imagine how amazed these workers were when they suddenly learned of the dramatic developments they had unknowingly contributed to. One cannot help having a similar feeling of amazement when reading this book.

The book is divided into two parts: "Survey" and "Collected Papers." Each part contains ten papers, written by Dr. Stone, the editor, and eighteen well known contributing authors. The first part describes the development of medical services for a vast project handling hitherto unknown large quantities of radioactive substances. Methods for protecting the personnel against various hazards were worked out and reliable values for maximum permissible exposures, both external and internal, to all kind of radiations were ascertained. This section contains detailed studies of the effect of ionizing radiations on blood, on distribution and excretion of uranium and plutonium, on management and treatment of persons exposed to radiation. Requirements of an adequate health service in relation to atomic research and industrial development are enumerated.

The second part of the book contains a number of important studies regarding radiation effects. Of special interest are those on the effects of total body exposures to roentgen rays, tolerance to whole body irradiation of patients with advanced cancer. Treatment of plutonium poisoning by metal displacement is an equally important contribution.

The book is filled with interesting and most useful information. The vast cooperative effort which is required to accomplish successfully the many tasks of an undertaking of the importance of the *Plutonium Project* is somewhat reflected in the number of forewords, prefaces and introductory notes. This book contains seven, not counting the introductory chapter by the editor. There is also some repetition, unevenness in length of chapters and extent of bibliographies noticeable throughout the book but that can hardly be avoided in any cooperative work. Due to the somewhat historic presentation of the material it is also difficult to bring all data up to date. Some values such as, for example, the permissible tolerance exposures as used now are lower than the ones given in the book.

These few defects are small compared to the great value of the material presented. The book can be highly recommended both for its scientific content as well as for its historic description of a great chapter in applied science.

Otto Glasser, Ph.D.

X-Ray Calibration of Radiation Survey Meters, Pocket Chambers, and Dosimeters. By Frank H. Day. National Bureau of Standards Circular 507. Issued July 25, 1951. Paper. Price, 15 cents. Pp. 11. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C.

This report describes the result of calibrations of various pocket dosimeters and survey meters. The instruments, both of the ionization and Geiger counter type, were made prior to December, 1948. Some of them have meanwhile been improved or changed and the user should ascertain the year of manufacture before applying the suggestions made in this report to his particular instrument. The investigated instruments comprise seventeen different models manufactured by the following companies: Beckman Co., Cambridge Instrument Co., El-Tronics Co., Instrument Development Laboratory, Kelley-Koett Manufacturing Co., National Technical Laboratories, Nuclear Instrument and Chemical Corp., Precision Radiation Instruments, Sylvania Electric Products, Victoreen Instrument Co. The response of these instruments to roentgen rays generated with potentials from 30 to 1,200 kilovolts was studied. Dosages of the roentgen-ray beams were measured with a free air ionization chamber for lower and with a cavity ionization chamber for higher voltages. The results of these calibrations show that instruments of a given type but constructed by different manufacturers show similar responses to roentgen rays in the 250 to 1,200 kilovolt range. For lower potentials, however, they show wide discrepancies. The reason for these considerable deviations lies in the variation of materials used in the chamber walls and electrodes. These effects are discussed in detail and instructions for proper construction and handling of as well as correction factors for the various instruments are given. Numerous figures illustrate this important and timely presentation.

Otto Glasser, Ph.D.

BOOKS RECEIVED

LEHRBUCH DER RÖNTGENDIAGNOSTIK. Von H. R. Schinz, W. E. Baensch, E. Friedl, E. Uehlinger, nebst Beiträgen von E. Brandenberger, A. Brunner, U. Cocchi, N. P. G. Edling, J. Eggert, F. K. Fischer, M. Holzmann, H. Krayenbühl, A. Lindbom, E. Lindgren, G. A. Preiss, S. Welin, A. Zuppinger. Fünfte, völlig neu bearbeitete und vermehrte Auflage. Band I. Skelett. Titelei, Vorwort, Inhaltsverzeichnis und Sachregister zu den Lieferungen 1 bis 4. Paper. Pp. 88. Georg Thieme, Diemershaldenstrasse, 47, Stuttgart, Germany (Grune & Stratton, Inc., New York, New York), 1952.

THE NORMAL CEREBRAL ANGIOGRAM. By Arthur Ecker, M.D., Ph.D. (Neurology), Surgical Neurologist, Syracuse, New York. Cloth. Price, $6.50. Pp. 190, with 140 illustrations. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1951.

CRANIOGRAFIA. ESAME SENZA MEZZI DI CONTRASTO E CON CONTRASTO. (Cisterno-encefalografia, ventricolografia, angiografia cerebrale.) (Craniography. Roentgenological Examinations without and with Contrast Mediums. [Cisternography and encefalography, ventriculography, cerebral angiography.]) By Prof. Mario Lenzi, Direttore dell' Istituto di Radiologia della Università di Modena. Paper. Price, L. 2000. Pp. 77, with 38 illustrations. Casa Editrice Cappelli, Bologna, Italia, 1952.

ANGIOCARDIOGRAPHY AS A DIAGNOSTIC AID IN CONGENITAL HEART DISEASE. By J. W. C. de Groot, M.D. From: The Department of Paediatrics and Child Health, University of Birmingham, England, and University Clinic of Paediatrics, University of Amsterdam, Holland. Cloth. Pp. 108, with 20 illustrations. Systemen Keesing, Ruysdaelstraat 71, Amsterdam, Holland, 1951.

SOFT TISSUE RADIOGRAPHY. Technical Aspects and Clinical Applications in the Examination of Limbs. Acta radiologica, Supplementum 85. By Arne Frantzell. Paper. Price, Swedish Crowns 20:–. Pp. 103, with 37 illustrations. Acta radiologica, Stockholm 2, Sweden, 1951.

TOPOGRAPHISCHE AUSDEUTUNG DER BRONCHIEN IM RÖNTGENBILD MIT BERÜCKSICHTIGUNG DER NEUZEITLICHEN NOMENKLATUR. Von Priv.-Doz. Dr. med. Claus Esser, Mainz. Paper. Price, DM 33.–. Pp. 152, with 77 illustrations. Georg Thieme, Diemershaldenstrasse, 47, Stuttgart, Germany (Grune & Stratton, Inc., New York, New York), 1951.

DIAGNOSTIC AND EXPERIMENTAL METHODS IN TUBERCULOSIS. By Henry Stuart Willis, M.A., M.D., F.A.C.P., Superintendent and Medical Director, North Carolina Sanatoria, McCain, North Carolina, etc.; and Martin Marc Cummings, M.D., F.C.C.P., Director, Tuberculosis Research Laboratory, Lawson Veterans Administration Hospital, Veterans Administration, Chamblee, Georgia, etc. Second edition. Cloth. Price, $10.00. Pp. 373, with numerous illustrations. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1952.

TRANSIT TIME THROUGH THE SMALL INTESTINE. A Roentgenologic Study on Normal Variability. Acta radiologica, Supplementum 88. By Lars Lönnerblad, Västervik, Sweden. Paper. Price, Swedish Crowns, 20:–. Pp. 85, with 32 illustrations. Acta radiologica, Stockholm 2, Sweden, 1951.

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Vol. 69, No. 1

ABSTRACTS OF RADIOLOGICAL LITERATURE

Department Editor: T. Leucutia, M.D., Harper Hospital, Detroit 1, Michigan

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ROENTGEN DIAGNOSIS

Neck and Chest

Raphael, Robert, L., Schnabel, Truman G., Jr., and Leopold, Simon S. A new method for demonstrating an aberrant right subclavian artery. *Radiology*, Jan., 1952, *58*, 89–93.

The authors describe a new method of roentgenologically observing the actual course of an aberrant right subclavian artery. The right brachial artery is punctured with a No. 19 special thin-walled needle through which a radiopaque catheter, 70 cm. in length, is inserted into the artery.

Under fluoroscopic observation the catheter is seen to pass behind the barium-filled esophagus, while in the normal subject it passes in front of the esophagus.

The anomaly may interfere with swallowing or produce substernal pain by pressing upon the esophagus. The barium-filled esophagus usually demonstrates an oblique extrinsic defect just above the aortic knob, passing upward from the left to the right. The esophageal defect may produce an anterior bulge simulating a diverticulum.

The catheterization does not involve surgical procedure and no damage to the artery catheterized has been demonstrated.

This method is much less intricate, more certain, and less dangerous to the patient than angiocardiography.

A typical case is presented.—*E. E. Seedorf, M.D.*

Heckmann, K. Elektrokymographie (Aktinokardiographie) und Phasenanalyse des Herzens. (Electrokymography [actinocardiography] and phase analysis of the heart.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Jan., 1952, *76*, 60–69.

The technique of electrokymography is described in detail. A simultaneous phonocardiogram is made. The curves are scrutinized in great detail by using the phase analysis. With this the motion of the entire ventricle can be studied not just that of a single point of the ventricle.

Phase analysis is compared to studying the heart with a magnifying glass. The apex of the heart lags behind the other parts of the ventricles in its centripetal movement during systole. This "latent period" differs with the various segments of the ventricle. This finding is explained by the architecture of the cardiac muscle.—*Frederick M. Reis, M.D.*

van Lingen, B., McGregor, M., Kaye, J., Meyer, M. J., Jacobs, H. D., Braudo, J. L., Bothwell, T. H., and Elliott, G. A. Clinical and cardiac catheterization findings compatible with Ebstein's anomaly of the tricuspid valve; a report of two cases. *Am. Heart J.*, Jan., 1952, *43*, 77–88.

In Ebstein's malformation the displaced tricuspid valve divides the right ventricle into two parts and thereby causes the proximal portion to be continuous with the cavity of the right atrium. The anomalous valve is so arranged, however, that it is competent. The primary effect of the anomaly is to reduce the efficiency of the right heart, and as the thin-walled proximal chamber of the right ventricle cannot empty itself completely, it enlarges progressively. Usually the foramen ovale remains open and venous blood is shunted from right atrium to left and from there to the systemic circulation. The distal right ventricular chamber, which receives less than the normal volume of blood, delivers an inadequate amount of blood to the lungs.

The diagnosis of Ebstein's malformation was made in 2 patients on the basis of right heart catheterization which demonstrated a significant difference in pressure in the proximal and distal portions of the right ventricle. A similarity of pressure in the right atrium and proximal portion of the right ventricle was confirmed by continuous tracing recorded while the catheter tip was withdrawn from the pulmonary artery to the superior vena cava.

Arterial unsaturation in one and a marked diminution of arterial oxygen saturation in both patients during exercise indicated a venous-arterial shunt probably occurring through the atrial septum (patent foramen ovale).

The pulse contours in the distal right ventricle were distinctive—a gradual rise and fall of systolic pressure and an abbreviated diastolic plateau. The proximal right ventricular chamber showed only slow small rise and fall of systolic pressure as contrasted to the normal steep rise and fall in right ventricular pressure.

The clinical symptoms of the anomaly are: (1) delayed and insidious onset of cyanosis, (2) mild dyspnea, and (3) easy fatigability. The clinical signs are: (1) cardiac enlargement, (2) poor heart sounds, (3) systolic murmurs, (4) arterial oxygen unsaturation, (5) compensatory polycythemia, and (6) prolonged circulation time.

Roentgenologically there is marked enlargement of the right ventricle with poor pulsation of this chamber segment, concavity in the pulmonary artery area, abnormally clear lung fields, and absent pulsations in the pulmonary arteries.—*Harold Fulton, M.D.*

Dodrill, F. D. Double aortic arch. *Surgery*, Feb., 1952, *31*, 204–211.

Usually, only the fourth left bronchial arch persists to form the aortic arch. When both fourth bronchial arches persist, double aortic arch results. One arch passes in front of the trachea and esophagus, and the other arch behind, thus encircling the

trachea and esophagus by a vascular ring. Griswold and Young's review of the literature on double aortic arch, in 1949, uncovered 47 cases, in which 5 patients had been operated on, with 3 deaths. The author reports on 2 patients successfully treated.

Clinical signs and symptoms result from compression of the trachea and esophagus, and consist of wheezing, cough, dyspnea, dysphagia and varying degrees of tracheobronchial pulmonary infection. Symptoms usually appear soon after birth. The nature of the symptoms depends on the degree of constriction, which may be slight or absent. The condition may be discovered only at necropsy.

Diagnostic measures include the swallowing of barium, the making of lateral roentgenograms of thorax and tracheograms, and the use of bronchoscopy, each procedure aimed at visualizing compression of either trachea or esophagus.

The author emphasizes three points as contributing to successful operation: (1) use of a noncollapsible intratracheal tube during operation; (2) mobilization of the aorta, if necessary, in order to find the double structure; and (3) complete dissection of the vascular ring from the trachea and esophagus.—*André Bruwer, M.B., Ch.B.*

LERICHE, RENÉ, BEACONSFIELD, PETER, and BOËLY, COLETTE. Aortography: its interpretation and value; a report of 200 cases. *Surg., Gynec. & Obst.*, Jan., 1952, *94*, 83–90.

Aortography has added another valuable method of investigating certain types of disease:

Thromboangiitis obliterans. This is a generalized vascular disease characterized, as a rule, by a small vascular wall lesion and an extensive thrombosis. The aortography shows an intact arterial wall and very few, if any, collaterals. The circulation of the main trunk is not re-established below the lesion and there is a generalized peripheral vasospasm.

Arteriosclerosis obliterans. This group includes the atheromatous type and Monkeberg's sclerosis. The findings on aortography show the diameter of the vessels to often be increased and their course to be tortuous. Obliterations are numerous and the collateral vessels are well developed.

Mixed arteritis. This group includes those cases which show a segmental endarteritis obliterans with proliferation of the intima but without true atheromatous changes.

Endarteritis of the bifurcation of the aorta. This condition with complete obliteration was first described as a new syndrome in 1940. It occurs in young men who have difficulty in erection, extreme fatigability of the lower extremities, slow atrophy of the leg muscles, and moderate ischemia.

Aneurysm and arteriovenous fistula. The diagnosis in these conditions is usually made clinically and the value of aortography lies in the exact localization of the lesion.

In general, the value of aortography as a diagnostic method of investigation is rather limited. It is confined to extravascular conditions such as renal and suprarenal tumors or other abdominal masses in which it is used as a supplement to other diagnostic procedures. In cases of traumatic or congenital pelvic aneurysms, a good roentgenogram of the lesion will greatly facilitate the surgeon's task by localizing the pathologic condition. The same holds true for arteriovenous fistulas. In emergency embolectomies, aortography is usually unnecessary as a careful physical examination will reveal the location of the obstruction. In the 2 patients with traumatic lesions of the iliac vessels seen by the authors, the site and extent of the injuries were well shown by aortography.

In peripheral vascular disease, aortography should be employed only if resection or reconstructive surgery of the vascular lesion is to be considered. Here, the translumbar puncture of the aorta is the method of choice.

In the group of patients with relatively normal arterial walls (*viz.*, suspected abdominal or retroperitoneal tumors) aortography is done by the retrograde catheter method.—*Mary Frances Vastine, M.D.*

LEVY, LOUIS, II, FOWLER, RICHARD, JACOBS, HAROLD, LECKERT, JOHN, IRION, JOHN, ROSEN, IRVING, and CHASTANT, HAROLD. Angiocardiographic confirmation of pericardial effusion. *Am. Heart J.*, Jan., 1952, *43*, 59–66.

The authors have studied 11 patients in the past year by angiocardiography to confirm or rule out pericardial effusion. A relatively small amount of contrast material is required for injection as visualization of only the right heart chambers is necessary to make the diagnosis.

Pericardial effusion usually gives clinical signs of cardiac compression, but signs and symptoms may be entirely absent even with a large effusion. Conversely, a dilated heart may result in a symptom-complex closely simulating that of pericardial effusion. These are the types of cases in which angiocardiography is of great value.

A shadow outside the limits of the contrast-filled cardiac chamber is considered to be due to pericardial effusion or pericardial thickening by exudate. Small amounts of fluid usually cannot be demonstrated. The thickened ventricular muscle wall of cardiac hypertrophy should not be confusing since there is no increase in the size of the cardiac silhouette associated with cardiac hypertrophy.—*Harold Fulton, M.D.*

ABDOMEN

OBERHOLZER, J. Die Bedeutung der röntgenologischen Anastomosenkontrolle nach Opera-

tionen an Magen und Oesophagus. (The importance of the roentgenological check-up examination of the anastomosis following surgery on the stomach and esophagus.) *Schweiz. med. Wchnschr.*, Feb. 16, 1952, *82*, 182–185.

A roentgenological check-up examination of the anastomosis following gastric or esophageal operation is indispensable.

The author recommends such an examination in every case and states that this is done routinely in his institution.

He found that the remaining portion of the stomach emptied rapidly when thin barium was given and the patient examined in the standing position. With thicker contrast meal and with the patient lying down, the emptying was slower but more perfect. The emptying was complete in all cases within one hour.

A gastroenterostomy should lie at the lowest point. The barium should empty entirely into the efferent loop and no filling of the afferent loop should take place. This is of particular importance when the stomach has been resected for a duodenal ulcer without removing the ulcer itself.

It is often difficult to evaluate the importance of a secondary gastritis following gastric surgery. Such gastritis may involve the entire portion of the remaining stomach or may be limited only to the region of the anastomosis. A mild form of such a gastritis exists in practically every case. This, however, is usually not accompanied by any subjective complaint. The gastritis may sometimes be so marked that the accompanying swelling of the mucosa interferes with the emptying mechanism. This gastritis disappears rather rapidly and necessitates only very rarely a secondary operation.

The author draws the following conclusions from his observation:

(1) A roentgenological study of the anastomosis following resection of the stomach or esophagus is definitely indicated before the patient leaves the hospital.

(2) The harmonious cooperation between the radiologist and the surgeon is necessary in order to evaluate satisfactorily these examinations.

(3) The importance of the control of the surgical technique by the surgeon through the radiologist must be emphasized.

(4) A revision of the surgical procedure is indicated only when the roentgenological examination shows an unsatisfactory anastomosis and when such an anastomosis is accompanied by severe clinical symptoms; otherwise, it is recommended to repeat the roentgenological examination in approximately six months.

(5) The evaluation of the roentgenological examination of the anastomosis in conjunction with the clinical findings allows valuable direction for the often neglected post surgical care of the patient.—*H. Peter Mueller, M.D.*

Welbourn, Richard B. Benign ulcers of the greater curvature; associated with ulcerative colitis and cirrhosis of the liver. *Brit. J. Surg.*, Jan., 1952, *39*, 303–308.

This is a case report of a woman, aged twenty, who developed ulcerative colitis and had an ileostomy performed. Three years later she was found to have a duodenal ulcer, three chronic peptic ulcers (proved histopathologically) on the greater curvature of the stomach and portal cirrhosis of the liver. She successfully underwent subtotal gastrectomy and splenicorenal anastomosis. There is evidence that ulcerative colitis produces deficient absorption of amino acids and that this may produce cirrhosis of the liver. Cirrhosis may predispose to the development of peptic ulcers.

A review of the literature demonstrates only 19 other reported cases of benign ulcer of the greater curvature of the stomach, excluding those in the prepyloric area. Some speculation is given as to the reason for the lack of chronic ulcers and the relative frequency of acute ulcers in this region. The author suggests that mechanical factors (friction of food), firm attachment of mucosa, absence of protective mucin, relatively poor blood supply and the junction of the acid and alkaline secreting areas may play a role in the high incidence of chronic ulcers on the lesser curvature.—*Frank R. Hendrickson, M.D.*

Harrison, B. B. Colonic replacement of the stomach; early results of radiological investigation. *Lancet*, Jan. 5, 1952, *1*, 25–28.

Following partial gastrectomy, a segment of transverse colon 6 to 7 inches long (with intact nerve and blood supply) is resected and anastomosed between the gastric and duodenal stumps. In contrast with the usual gastrojejunal shunt created following gastrectomy, this new procedure maintains a more normal stomach-duodenum-jejunum route for ingested food. The author briefly discusses the obvious physiological advantages to be expected from the method and describes his preliminary impressions obtained in a follow-up study (fluoroscopy and roentgenography) of 70 patients operated upon between January and November, 1951.

After three to six months the transplanted colon tends to lose its haustration and assume the appearance of a muscular tube. As time passes, the stump of the stomach initiates a rhythmic passage of barium into the colonic segment and duodenum, similar to the normal rhythm and unlike the undesirable "dumping" which occurs through a gastrojejunostomy. It is interesting that the colonic segment maintains its peristaltic polarity and exhibits frequent mass expulsive movements from *right to left*, pushing barium back into the gastric stump, since its

proximal end has been sutured to the duodenum and the distal end sutured to the stomach. This peristaltic confusion contributes a churning action which is of distinct advantage in digestion and does not appear to prevent a normal over-all emptying time.

Judging by preliminary clinical and roentgenological evidence, this ingenious operation may help prevent the distressing symptoms which so often follow the Polya type of gastrectomy and anastomosis. All except one of the 70 patients have shown weight gain and good capacity for normal meals during early follow-up. The reasons for operation are not tabulated in this paper, but apparently many patients were given the colonic replacement as a reconstructive measure after previous conventional surgical procedures.—*S. M. Rogoff, M.D.*

CRILE, GEORGE, JR., HAZARD, JOHN B., and ALLEN, KENNETH L. Primary lymphosarcoma of the stomach. *Ann. Surg.*, Jan., 1952, *135*, 39–43.

Tle authors present the results in 19 cases of histopathologically proved lymphosarcoma of the stomach, treated between 1935 and 1950 at the Cleveland Clinic Hospital.

The histopathologic differentiation was based on Ewing's classification into: (1) reticulum cell sarcoma, which is felt to arise from the germinal centers, and interstices of reticulum fibers of lymphoid tissue, and (2) malignant lymphocytoma or lymphocytic lymphosarcoma which originates from immature or mature lymphocytes.

There was considerable variation in the gross appearance of the lesions. Ten cases showed solitary ulcerations, which usually were shallow, with surrounding irregular tumor masses of varying size; 3 cases showed multiple ulcers with associated diffuse infiltration as in linitis plastica; and 1 case had no tumor mass.

The anatomic distribution of the lesions was as follows: 7 were in the lesser curvature, 4 in the pylorus, 5 involved the entire body, and 3 were on the posterior wall. None were on the greater curvature. The authors feel that a gross diagnosis of the disease in the operating room is not dependable, and a biopsy should be taken routinely.

The average age of the patients was fifty-four years. Men outnumbered women 2 to 1. The most common symptom was epigastric pain which occurred in 13 patients, followed by gastric hemorrhage which was observed in 7. There was a weight loss of from 4 to 79 pounds, the average being 22 pounds. The average duration of symptoms was twenty-six months. Gastric analysis using standard alcohol meal was carried out in 15 patients; 1 patient had 70 units of free acid, 9 had 50 units, and 5 had none.

Roentgenological and gastroscopic findings are given and show that the tumor may be very variable and difficult to diagnose.

The treatment consisted of surgery alone, surgery and roentgen therapy and roentgen therapy alone. Of 10 patients seen from 1935 to 1945, five had subtotal gastrectomy and roentgen therapy. Of these, 4 patients were alive and well for five to twelve years and 1 patient died four years later of other causes. Five patients had surgery alone. Of these, 1 patient died ten years later of other causes and 4 died in the hospital after operation. Of 9 patients seen from 1946 to 1950, six treated by surgery plus roentgenn therapy were alive and well six months to four and a half years, 1 treated by surgery alone was alive and well (duration not given), and 2 treated by biopsy plus roentgen therapy were alive and well three years and four years.

These results demonstrate that the prognosis in lymphosarcoma is much better than in carcinoma of the stomach. The authors believe that a combination of surgery and roentgen therapy is the treatment of choice.—*Leslie L. Lemak, M.D.*

CATTELL, RICHARD B., and MUDGE, THOMAS J. The surgical significance of duodenal diverticula. *New England J. Med.*, Feb. 28, 1952, *246*, 317–324.

Duodenal diverticula usually cause no symptoms and when they do, there is no clear-cut clinical pattern.

Roentgenological examination shows an incidence of about 1.5 to 1.9 per cent while autopsy figures are much higher—11.6 to 14.5 per cent. They are usually found in the older age group, although the patients in this report varied from twenty-six to sixty-nine, with an average of fifty years. There is equal distribution in the sexes.

The etiology is presumed to be a congenital weak area in the wall that gradually balloons out. The point may be a blood vessel entrance or exit or the site of aberrant gastric or pancreatic tissue.

The true diverticulum is one which contains all the bowel layers while the false diverticulum has one or more layers missing. Pseudodiverticula are relative outpocketings seen with scar contraction.

This report concerns 25 cases operated upon at the Lahey Clinic in the last ten years. In 22 patients the diverticula presented on the concave border of the duodenum, in 2 they were associated with aberrant gastric mucosa and in 1 with aberrant pancreatic rest. Thirty-three per cent had concomitant diverticulosis of the colon and 1 patient had diverticula in jejunum and colon. Multiplicity is common in duodenal diverticula.

The complaints had few points of differential value. Only 12 of the 25 patients had the diverticulum as the sole disease and had satisfactory postoperative results. In these, pain in the upper abdomen was the most common complaint and less frequently flatulence, weight loss, melena, nausea and vomiting. The duration of symptoms averaged six years and the patients had other operations and various forms of medical treatments. Since so many other conditions can cause similar complaints care must be taken in choosing the operative cases.

The larger diverticula with narrow necks are more likely to cause trouble than the small ones. The abdomen should be palpated over the lesion to check tenderness. The rate of emptying should be determined. Lesions in the gallbladder, stomach and bowel must be excluded. Then a prolonged trial of conservative measures may be tried to determine if the diverticulum is the cause of the complaints. In cases associated with other pathology the question of removal of the tic is deferred till surgery.

Of their cases, 24 had excision of the sac and 1 had a subtotal resection with gastrojejunostomy because of considerable inflammation. The neck is divided a short distance from its origin to avoid narrowing of the duodenum and to prevent leakage. The 2 patients who had postoperative complications and died did so as a result of leakage of pancreatic enzymes. Six of the 25 cases had subacute or chronic inflammation. Perforation and gangrene have been reported. One had a gallstone in the sac.

The results in 17 of the 25 patients can be considered due only to the removal of the diverticulum since either only the tic was excised or no other significant operation done; in these, 9 had excellent results, 3 fair and 5 poor. There was an 8 per cent operative mortality.—*Martha Mottram, M.D.*

Miller, Joseph M., Freeman, Irving, and Heath, William H. Calcinosis due to treatment of duodenal ulcer. *J.A.M.A.*, Jan. 19, 1952, *148*, 198–199.

The authors state that Burnett *et al.*, in 1949, reported 6 cases of hypercalcemia, calcinosis, and renal insufficiency, without hypercalciuria or hypophosphatemia, in patients with a history or symptoms of peptic ulcer, who had received excessive amounts of milk and absorbable alkali.

They then report a case of their own in a forty-one year old white male who had abnormal calcium deposits and hypercalcemia due to prolonged treatment of a duodenal ulcer with milk and adsorbable alkali. The duodenal ulcer was finally successfully treated by gastric resection and there was concurrent improvement in the renal function.—*R. D. Moreton, M.D.*

Piaggio Blanco, Raúl A., Montero, Eustaquio, and Gonzalez Leprat, Juan A. Esplenomegalia desplazando hacia adelante el riñón izquierdo y el ángulo duodenoyeyunal. (Splenomegaly displacing the left kidney and the duodenojejunal angle forward.) *An. Fac. de med. de Montevideo*, Jan.–Feb., 1952, *37*, 31–38.

A case is presented in which the greatly enlarged spleen displaced the left kidney anteriorly and medially, and detached and displaced forward the duodenojejunal angle and superior extremity of the mesentery. Anatomic relations were studied by contrast studies of the upper gastrointestinal tract, colon and urinary tract. After splenectomy, spontaneous replacement of the viscera to normal position was verified. An intimate relationship between the abdominal walls and the contained organs is postulated to explain the spontaneous return of the viscera to normal position.—*Charles M. Nice, M.D.*

Mullen, Wylie H., Jr., and Makielski, Louis J. The lateral decubitus position in cholecystography. *Cleveland Clin. Quart.*, Jan., 1952, *19*, 20–27.

The authors point out that the use of the right lateral decubitus position will frequently permit visualization of the gallbladder without overlying gas shadows. As done at the Cleveland Clinic, the patient is placed on his right side on a mobile table with a well in it into which the right flank is allowed to sag, thus decreasing his anteroposterior diameter. An upright Bucky holds the film against the right upper quadrant and the roentgen beam is directed transversely. Several roentgenograms are reproduced to show the value of the position.—*H. J. Klos, M.D.*

Carter, R. Franklin, and Saypol, George M. Transabdominal cholangiography. *J.A.M.A.*, Jan. 26, 1952, *148*, 253–255.

The authors cite the three stages of intra-abdominal biliary tree contrast visualization which prompted the use of the transabdominal method.

The intra-abdominal methods are well known and used. The simplest type consists of cannulating the common bile duct. In the presence of stenosis of the common bile duct or common hepatic duct, a needle may at times be passed through the stenotic segment and injection made proximal to the stenosis. The third method consists of passing a needle through the liver substances, aiming for the right or left main intrahepatic duct. The duct may be recognized by increased resistance to the needle. When the stilette is withdrawn from the needle, bile may be obtained. The lack of complications of this transhepatic method prompted consideration of the use of a transabdominal technique in selected inoperable cases.

A case report is presented in which the transabdominal method was used in a patient with severe obstructive jaundice of seven months' duration. Following paracentesis, transabdominal cholangiography was performed by passing a needle through the abdominal wall into the left biliary tree. Upon obtaining bile from the needle, iodopyracet solution (diodrast) was injected. The cholangiograms obtained showed marked distention of the intrahepatic biliary ducts with complete obstruction at the liver hilus.

The needle so placed was used therapeutically as an operative choledochostomy. The patient subsequently died from massive hemorrhage from esophageal varices.—*I. R. Berger, M.D.*

SMITH, PARKE G., RUSH, T. W., and EVANS, ARTHUR T. The technique of translumbar arteriography. *J.A.M.A.*, Jan. 26, 1952, *148*, 255–258.

In the presence of renal malignancy, the renal vessels may show an irregular pattern and a tendency for the contrast medium to "pool" and "puddle." Cysts are characterized by an avascular zone at arteriography.

Other uses of abdominal arteriography lie in its ability to demonstrate potential renal function as related to existing renal blood supply, visualization of anomalous vessels, aneurysms of abdominal aorta and its branches, and renal infarcts. Retroperitoneal masses may be differentiated from renal lesions by virtue of a normal renal arterial pattern in the presence of a retroperitoneal mass.

The authors base their views on their experiences with transabdominal arteriography in 668 patients. The selection of these patients was limited only by uremia and inability to withstand thiopental sodium anesthesia. They record no deaths, have had no extra-aortic hemorrhage and minimal morbidity. Thirty-six of 70 dying patients who came to autopsy were examined six hours to twenty-four days after the procedure. In 6 cases there was bleeding outside of the aorta, the hemorrhage occupying an area the size of a golf ball.

The surgical phase of the procedure begins after the patient is anesthetized in prone position. The special arteriography needle is inserted into the left flank, 8 cm. lateral to midline, just below the twelfth rib, so that its point advances superiorly, ventrally and medially to touch the twelfth thoracic vertebral body; it is then withdrawn and advanced again in a more ventral direction to enter the abdominal aorta.

Injection of 12 cc. of 75 per cent neo-iopax or 70 per cent diodrast follows.

The roentgen interpretation of the arteriograms obtained is one of the more difficult aspects of the problem. This problem may be surmounted only by experience.—*I. R. Berger, M.D.*

PIQUINELA, JOSÉ A. Vólvulo de ciego. Los vólvulos del colon derecho. (Volvulus of the cecum; volvulus of the right colon.) *An. Fac. de med. de Montevideo*, Jan.-Feb., 1952, *37*, 3–30.

Acute volvulus of the isolated cecum is rare, more often following abnormal mobility of the cecum and ascending colon due to faulty development; there is the relatively common asymptomatic partial volvulus of portions of the right colon. The majority of cases occur between the ages of twenty and forty years, predominating, according to some authors, in men and according to others, in women. Adhesions, such as in the neighborhood of the hepatic flexure, gas-producing diets and sufficiency of the ileocecal valve, are regarded as accessory factors to the prime factor of abnormal ileocecal mobility. Other precipitating factors include trauma, violent purgation, mesenteric adenitis, foreign bodies, abdominal and pelvic tumors, chronic intestinal stasis and typhoid fever.

Pain, shock and abdominal distention are prominent clinical findings. Cecal volvulus may be acute or chronic, and the acute forms may develop in an acute, subacute or chronic manner. The roentgen picture of a dilated cecum and ascending colon displaced toward the center of the abdomen is characteristic.

Treatment is surgical. Conservative surgical procedures such as detorsion, cecal drainage and cecocolic fixation may be tried, but resection is mandatory in strangulating cases where bowel viability is in question.—*Charles M. Nice, M.D.*

COLP, RALPH, and DREILING, DAVID A. Persistent or recurrent proximal ileitis following surgery. *A. M. A. Arch. Surg.*, Jan., 1952, *64*, 28–46.

This article discusses the treatment of recurrent ileitis which the authors feel is as high as 20 per cent of all cases studied. This does not depend upon the primary form of treatment which they feel should be an ileocholostomy with ileal exclusion. Recurrence results from skip areas of incipient disease in the proximal ileum which are present at the time of anastomosis to the transverse colon during the initial treatment. In these cases of recurrent disease where an ileal transverse colostomy has been previously performed the treatment of choice is a secondary ileal division with ileosigmoidostomy. The point of ileal division should be at least 60 cm. proximal to the last visible segment of disease. It is advisable at the time of operation to make a biopsy of the ileum at the site at which the new anastomosis is to be made.

The follow-up results in the authors' 10 cases of recurrent proximal ileitis treated with a secondary exclusion operation showed a secondary recurrence rate for this procedure of 11 per cent.—*Robert P. Barden, M.D.*

HAGGIE, MICHAEL. Indications for barium enema in the diagnosis of carcinoma of the colon. *Lancet*, Jan. 5, 1952, *1*, 21–23.

The author has analyzed 110 cases of carcinoma of the colon admitted to the London Hospital in 1946, 1947 and 1948, to attempt to discover how the condition was diagnosed in the hope that this might more clearly define the indications for barium enema examination. A total of 104 cases were confirmed as being carcinoma at operation or at necropsy.

The author concludes that an investigation of colonic symptoms must include a digital examination

of the rectum and rectosigmoid, followed by endoscopic examination. The barium enema examination is unnecessary in the diagnosis of carcinoma of the colon in most cases and its primary use is in the localization and extent of the suspected tumor mass. —*Moris Horwitz, M.D.*

Gynecology and Obstetrics

Kaltreider, D. Frank. Pelvic shape and its relation to midplane prognosis. *Am. J. Obst. & Gynec.*, Jan., 1952, *63*, 116–121.

The classification of pelves by visual methods into gynecoid, anthropoid, platypelloid, and android is difficult. Consistency is lacking. Lilienfeld, Treptow, and Dixon have demonstrated that classifying pelves is not a simple procedure. Two different observers agreed on the classification of the anterior segment 52 per cent of the time and on the posterior segment 59 per cent of the time. There is apparently no uniformity in evaluation of shape by different observers. Even more important is the fact that when one individual classifies a pelvis more than once he will not agree with himself more than 62 per cent of the time.

An interspinous diameter of 9.0 cm., anteroposterior diameter of the midplane of 12.0 cm., and posterior sagittal diameter of the midplane of 4.6 cm. may be border line in the midplane. Patients with pelves of any shape may have difficulty in the midplane regardless of size: 4.5 per cent when the diameters are above borderline; about 10 per cent when the interspinous diameter is over borderline and the anteroposterior diameter of the midplane or posterior sagittal diameter of the midplane is below border line; and 35 per cent when the interspinous diameter is 9.0 cm. or below.

Patients with gynecoid and platypelloid pelves and interspinous diameter over 9.0 cm., anteroposterior diameter of the midplane over 12.0 cm. and posterior sagittal diameter of the midplane over 4.6 cm. will probably have little trouble. An interspinous diameter of 9.0 cm. or less may be more dangerous in the gynecoid and platypelloid pelves than in the android and anthropoid pelves.—*Eugene J. McDonald, M.D.*

Freeth, Derek. Hysterosalpingography in female infertility; a comparison of lipiodol and viskiosol six. *Lancet*, Jan. 5, 1952, *1*, 15–19.

The author briefly reviews the history of hysterosalpingography and concludes that ample evidence is available in the reports of previous authors to abandon the use of an oily contrast medium. He states that a new water-soluble medium viskiosol six overcomes the main disadvantages of an iodized oil, mainly foreign body reaction, flairup of pelvic inflammation, and oil emboli. Delayed absorption of the water-soluble medium is stated to be pathognomonic of hydrosalpinx.

The author feels that patients investigated by the method of hysterosalpingography fall into three major groups: (1) those with bilateral tubal occlusion; (2) those with normal bilateral tubal patency and normal tubal appearance, position, and function; (3) those with some degree of abnormality, such as stenosed tubes and unilateral blockage. All of these contribute to lowered fertility in the patient but were not stated to be definite bars to conception. —*Moris Horwitz, M.D.*

Rozin, Samuel. The x-ray diagnosis of genital tuberculosis. *J. Obst. & Gynaec. Brit. Emp.*, Feb., 1952, *59*, 59–63.

Hysterosalpingograms of cases of tuberculosis of the female genital organs are demonstrated, in which the diagnosis of tuberculosis was established on the basis of the following methods: histological examination of the uterine mucosa; inoculation of mucosal material into guinea pigs; culture of tubercle bacilli from menstrual blood; as well as cervical and vaginal smears.

Probable signs are occlusion in the interstitial or midportion of the tubes, which are very constricted and devoid of peristalsis; or niches at the abdominal end of the tubes, resembling fistulae.

Very probable signs are a shrivelled, deformed uterus in which the corpus is approximately one-fourth to one-fifth the length of the cervix; a tendency to lymphatic penetration of lipiodol and to tight closure of the tubes. The tubes are devoid of peristalsis or are sacculated, or cast non-homogeneous shadows resembling cotton plugs at their abdominal end; or exhibit filling defects in the tubal lumen. Two or more of such signs may be considered the equivalent of a reliable sign.

Reliable signs are calcification of lymph nodes in the small pelvis; calcification and stone formation in the tubal lumen; and calcification of one or both ovaries.—*Eugene J. McDonald, M.D.*

Guilhem, P., Pontonnier, A., Enjalbert, A., and Baux, R. Aortographie avec clichés en série pour localisation placentaire. (Aortography with serial exposures for localization of the placenta.) *Bull. féd. Soc. de gyn. et obst.*, 1952, *4*, 166–169.

A case of suspected placenta previa with breech presentation was examined by lumbar aortography to visualize the placenta. Fifty cubic centimeters of 70 per cent diodrast was injected and one roentgenogram made at the end of the injection, followed by three others exposed at two second intervals; the last in the series were stereoscopic roentgenograms.

Two roentgenograms are reproduced. The first of the series shows filling of the abdominal arteries and puddling of the contrast medium in the placental

sinusoids; the last, taken six seconds, after the injection, shows the diodrast in the sinusoids only. The placenta on the stereoscopic roentgenograms was visualized in the anterior upper and middle uterine segment. No diodrast was seen in the fetal circulation.

There were no ill affects observed on the baby born six weeks later.

The amount of diodrast used by the authors is considerably larger than that used by Evans, who obtained good visualization of the placenta with 12 cc. of 75 per cent neo-iopax or 70 per cent diodrast.—*Karol E. Matzinger, M.D.*

Genitourinary System

Edelbrock, Harold H. Diagnosis of genitourinary tuberculosis. *Urol. & Cutan. Rev.*, Jan., 1952, *56*, 18–23.

A recent review of 5,424 autopsies from the Bellevue Hospital by Medlar has shown active genitourinary tuberculosis in 26 per cent of those dying from tuberculosis. Only 18 per cent of these had been diagnosed clinically by ante mortem studies. In this same series 45 per cent of those who had genitourinary lesions of a tuberculous character also had miliary tuberculosis; whereas only 3 per cent of those dying with extragenitourinary tuberculosis showed evidence of miliary tuberculosis.

The pathogenesis of renal tuberculosis and genitourinary tuberculosis is briefly reviewed and a clinical classification of genitourinary tuberculosis, as derived from the pathogenesis, is indicated as follows: (1) The pre-clinical lesions in which the minute foci have produced no symptoms. In this group will be found those with miliary tuberculosis and some with more isolated small lesions which may heal or progress. (2) Nodular tuberculosis where lesions of less than 1 mm. up to 1 cm. may form usually in the renal cortex. (3) Small ulcerative lesions involving the apex of the renal pyramid. (4) Caseocavernous tuberculosis.

Three clinical groups of patients are distinguished: (1) Those patients with signs and symptoms of genitourinary disease but no other obvious tuberculous focus. (2) Patients in whom the genitourinary tract becomes involved while under treatment for other tuberculous lesions. (3) Patients in whom a routine urinalysis reveals positive findings for tubercle bacilli.

Probably the most important single finding to indicate a need for careful genitourinary study is the presence of pus cells in the urine without any evidence of bacteria. Frank or microscopic hematuria also requires complete genitourinary study.

Special attention must be paid to the bacteriological diagnosis. A single negative smear, guinea pig, or culture test is not sufficient to rule out a tuberculous lesion. False positive smears as well as false negative bacteriological tests may occur.

The excretory urogram should be the first roentgenological procedure and should give function and morphology of the upper urinary tract. Roentgen signs are well known, and probably the most classic lesion is the corticomedullary ulceration or cavitation adjacent to the minor calyx. Renal parenchymal calcification and a small contracted bladder are also suggestive roentgen signs.

Cystoscopic examination should be carried out and may reveal involvement of the mucous membrane of the bladder with or without other findings. When necessary, ureteral catheters can be passed and retrograde pyelograms done. It is well to remember that in the evaluation of the excretory urogram, a careful study of the uninvolved kidney is important.—*G. W. Chamberlin, M.D.*

Ungerleider, Jerome L. Uterus unicornis unicollis associated with renal agenesis and malformation of the bony pelvis. *Am. J. Obst. & Gynec.*, Jan., 1952, *63*, 200–202.

This single case report illustrates anomalies of the genitourinary tract due to a lack of development of the wolffian duct and of the lower two-thirds of the müllerian duct. The urogenital fold, formed from the intermediate cell mass, consists of the genital fold and the mesonephric duct. The former is the anlage of the ovary. The latter gives rise to the müllerian duct and the wolffian duct. The cranial portion of the müllerian duct develops into the fallopian tube, the middle portions form the fundus uteri, and the caudal portions produce the corpus uteri, cervix, and upper two-thirds of the vagina. The wolffian duct is the anlage of the collecting tubules, calyces and ureter.

In this case, the genital deformity appeared to be a uterus unicornis unicollis, with an associated agenesis of the right urinary system. The left tube, uterus, cervix, and vagina were probably formed by the left müllerian duct. It is likely that there was a complete arrest of the remaining two-thirds of this ductal system. Both the gynecologist and the urologist must be cognizant of the fact that when a malformation of either the genital or the urinary system is found, an anomaly of the associated system may be present.—*Eugene J. McDonald, M.D.*

Ewell, George H., and Bruskewitz, Harold W. Bilateral ureteral obstruction due to envelopment and compression by an inflammatory retroperitoneal process. *Urol. & Cutan. Rev.*, Jan., 1952, *56*, 3–10.

This is a case report of a rather unusual cause for ureteral obstruction. The authors note that Ormond in an article published in the *Journal of Urology*, Vol. 59, June, 1948, reports 2 patients with similar lesions. The case included in this article is that of a fifty-nine year old man who had no past illnesses considered of etiological significance. He had had

no history of urinary tract infection, bladder or prostatic troubles. He was first admitted because of left-sided backache which had persisted for many weeks and gradually became severe and colicky in nature. The urine at that time showed a trace of albumin and a few red blood cells. Roentgen examination showed a moderate degree of obstruction of the left ureter above the brim of the pelvis and dilatation of the calyces and renal pelvis. In view of the pain in the left loin, absence of function of the left kidney, and evidence of obstruction, a left nephrectomy was carried out, and the patient recovered. The pathological report of the tissue removed was acute and chronic pyelonephritis involving the left kidney, arterio- and arteriolar sclerosis of the intrarenal vessels, and moderate sclerosis of the renal artery. Four months later the patient was seen again because of vague gastrointestinal complaints with anorexia, vomiting and constipation. The nonprotein nitrogen on admission was 40 mg. per cent. Investigation revealed a hydronephrosis of the right kidney with dilatation of the right ureter similar to that which was previously noted on the left side. A nephrostomy was done on the right side and a ureterolysis was subsequently done in two stages. Pathological report of tissue removed from around the ureter showed fibro-adipose tissue with extensive fibrosis and subacute inflammation with acute arteriolitis. At the time that the lower ureter on the right side was exposed at laparotomy an effort was made to determine the nature of the enveloping tissue. No particular margins of this could be defined and it seemed to represent the normal retroperitoneal fatty tissue which had become involved in an inflammatory process.

There is no explanation why the lesions should have been progressive, first involving the left lower ureter and subsequently the right lower ureter. The exact origin of the infectious process was not determined.—*G. W. Chamberlin, M.D.*

Newman, Harry R., Lowman, Robert M., and Waters, Levin L. The problem of calyceal diverticulum. *Surg., Gynec. & Obst.*, Jan., 1952, *94*, 77–82.

The term "calyceal diverticulum" is used to describe a cavity containing urine arising peripherally or distal to the calyx to which it is connected by a narrowed isthmus. As a rule, the involved calyx presents little or no evidence of obstructive renal uropathy and the epithelial lining continues to that of the calyx. The lining of the diverticulum consists of transitional epithelium demonstrating the same histologic characteristics as that of the renal pelvis or calyx.

A solitary cyst of the kidney demonstrates no communication with the renal pelvis or calyx and shows a flattened cuboidal lining epithelium which differs from that of renal pelvis or calyces. Calcifications of varying size may be found in calyceal diverticula. The term "hydrocalyx" is utilized to define the dilatation of a renal calyx arising because of obstruction existing in the infundibulum of the involved calyx. A calyceal diverticulum, on the other hand, is situated peripheral to the calyx and is not a dilated major calyx or hydrocalyx.

There is no specific clinical picture associated with calyceal diverticulum. The predominance of cases has been noted in males.

On intravenous or retrograde pyelography the diverticulum appears as a sharply delineated rounded area with well defined regular margins. A characteristic finding is the retention of the opaque medium in the diverticulum following the withdrawal of the ureteral catheter in the retrograde pyelogram.

The authors present a group of 6 cases and describe the roentgen and surgical findings in 4 of them.—*Mary Frances Vastine, M.D.*

Lewis, Evan L., and Kimbrough, James C. Bilateral hypernephroma associated with polycystic disease. *Urol. & Cutan. Rev.*, Feb., 1952, *56*, 79–80.

A review of the literature shows that there have been reported a total of 7 cases of hypernephroma in polycystic disease. The case herein described is that of a thirty-nine year old white male, who was admitted to the Walter Reed Army Hospital in March, 1948, with a diagnosis of polycystic disease. At operation on March 30, the lower pole of the kidney was found to be solid tumor with the rest of the kidney containing numerous cysts. Biopsy of the tumor area showed adenocarcinoma of the clear cell type, primary in a polycystic kidney.

Postoperatively, the patient continued to have occipital headaches. The blood pressure was normal and the skeletal survey and chest roentgenogram showed no evidence of metastasis. He developed a staggering gait and vomiting. Electroencephalogram in July, 1948, was normal but in August showed a left-sided amplitude asymmetry. These signs were interpreted as indicative of brain metastasis. Radiation therapy was recommended. The patient received 1,600 r through each of three portals. In January, 1949, he became asymptomatic and was discharged in March, 1949. In June, 1951, he was re-admitted because of increasing size of the left kidney. Exploratory operation revealed numerous cysts over the entire surface of the kidney which were opened and found to contain clear yellow fluid. At the lower pole the cysts were firm and nodular, and a wedge biopsy was taken from a representative area. The microscopic diagnosis was clear cell carcinoma. The patient was then referred for further irradiation to the lower pole of the left kidney.

This case illustrates the unusual finding and rare phenomenon of polycystic disease associated with bilateral clear cell carcinoma of the kidney.—*George W. Chamberlin, M.D.*

FITZPATRICK, RAYMOND J., ORR, LOUIS M., GLANTON, JAMES B., and HAYWARD, JOSEPH C. Tumors of the spermatic cord; review of literature and report of two cases. *J.A.M.A.*, Jan. 26, 1952, *148*, 259–261.

A review of the literature yielded 284 reported cases of tumors of the spermatic cord. Histopathologically, benign connective tissue tumors included fibroma, myoma, lipoma, leiomyoma, dermoid cyst and hemangioma. Mixed cellular types such as fibromyxoma, lipomyxoma are frequent findings.

Among the malignant variants, lipo-, fibro-, osteofibro-, and reticulo-sarcoma are listed. In addition, malignant teratoma, embryonal carcinoma and mesothelioma form malignant varieties.

The authors report 2 cases:

Case I. A spindle cell sarcoma was removed from the left spermatic cord of a patient thirty-four years old. Fourteen years later he succumbed to metastatic fibrosarcomatosis of the lungs, liver and other abdominal viscera.

Case II. A lipoma was removed from the left spermatic cord. A similar tumor was resected from the same spermatic cord two years previously.—*I. R. Berger, M.D.*

DELL'ADAMI, G., and MENEGHINI, C. Die Insufflation des extraperitonealen Bindegewebes in der Röntgendiagnostik der oberen Harnorgane mit besonderer Berücksichtigung der Möglichkeiten der Stratigraphie. (Air insufflation of the retroperitoneal space for the roentgen diagnosis of the upper urinary tract, with special consideration of the possibilities of laminagraphy.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Jan., 1952, *76*, 77–82.

The method of retropneumoperitoneum by air injection into the presacral space seems technically easier and not as dangerous as the injection of air into the perirenal space. The authors used it without complications in over 100 patients.

The entire retroperitoneal space is shown, especially the kidneys, adrenals and upper ureters. Often it is possible to demonstrate the pancreas, especially if laminagraphy is used as first proposed by Bonomin. In the average case 600–700 cc. of oxygen is injected but sometimes as much as 1,200–1,500 cc. may be necessary.

It is possible to determine the shape, size and position of both kidneys. Occasionally an extrarenal pelvis can be demonstrated. The upper ureters are usually visible on laminagrams with air. The adrenals can be clearly demonstrated in almost all instances.—*Hans W. Hefke, M.D.*

MENEGHINI C., and DELL'ADAMI, G. Die Insufflation des extraperitonealen Bindegewebes in der Röntgendiagnostik der oberen Harnorgane mit besonderer Berücksichtigung der Möglichkeiten der Stratigraphie. (Retroperitoneal air insufflation in the roentgen diagnosis of the upper urinary tract with special emphasis on the possibilities of laminagraphy.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Feb., 1952, *76*, 181–190.

The method used by the authors (presacral retroperitoneal air insufflation) has been described in a previous paper (*Fortschr.*, Jan., 1952, *76*). They now report the results in pathological cases. The gas is usually distributed symmetrically on the right and left side, in the perirenal space. Asymmetry is due either to the fact that the gas enters one of the perirenal spaces with greater ease than the other or that one of the two spaces is obstructed by an inflammatory or neoplastic process. The clearest image is usually obtained within the region of the kidneys which are completely surrounded by the air. Laminagraphy is particularly valuable for study of changes in size and contour of a kidney.

In contrast to this, demonstration of the ureters is usually difficult, especially on the plain abdominal film but laminagraphy frequently permits visualization, mostly when the ureters are enlarged.

Finally, the examination of the adrenals is discussed. Here again, the laminagraphic study appears advisable and helpful.

The paper is illustrated with reproductions of roentgenograms and diagrams of 8 of the authors' cases.—*Egon G. Wissing, M.D.*

BRINEY, ALLAN K., and HODES, PHILIP J. Urinary incontinence in women; roentgen manifestations. *Radiology*, Jan., 1952, *58*, 109–112.

Stress urinary incontinence in women was studied roentgenographically after opacification of the bladder. Films were made with each patient in both erect and supine positions, as well as erect with straining. The urinary bladders in women with urinary incontinence were found to show a teat-like outpouching in the relaxed standing position. This configuration is considered typical of stress incontinence and is not found in normal nullipara or nullipara without urinary incontinence.

Stress incontinence may be due to obstetrical trauma or to functional neuromuscular deficiencies in the perivaginal and periurethral structures.—*A. W. Sommer, M.D.*

KLOSTERMYER, LOUIS L., and THOMPSON, JOHN J. Radiographic diagnosis of hydrocolpos in infants. *Radiology*, Jan., 1952, *58*, 100–103.

Hydrocolpos is a relatively rare congenital defect. An imperforate hymen may produce symptoms in

infancy or remain undiscovered until puberty. There usually are progressively increasing symptoms related to urination and defecation as the blind tract becomes distended with abnormally increased secretion of the cervical glands. A correct diagnosis permits prompt and simple correction by incision or aspiration.

A single case of hydrocolpos, in a two month old infant, is reported. A survey film of the abdomen revealed a dome-like density in the lower abdomen. Excretory urograms demonstrated lateral displacement of the right ureter and left hydronephrosis. The bladder was displaced to the right and forward. On incision of the imperforate hymen, 3 ounces of gray cloudy fluid drained out and the lower abdominal mass disappeared.—*A. W. Sommer, M.D.*

Skeletal System

Klein, Armin, Joplin, Robert J., Reidy, John A., and Hanelin, Joseph. Slipped capital femoral epiphysis; early diagnosis and treatment facilitated by "normal" roentgenograms. *J. Bone & Joint Surg.*, Jan., 1952, *34-A*, 233–238.

Early diagnosis and treatment of slipped capital femoral epiphysis are of paramount importance. A factor in delayed diagnosis and treatment has been the failure of even those alert to the possibility of slipping to recognize the early stigmata in the roentgenogram. The diagnosis of slipping of the upper femoral epiphysis is made from anteroposterior and lateral roentgenograms of the hips. To obtain a single roentgenogram of both hips, a cassette, 14 by 17 inches, is placed transversely beneath the pelvis. The anteroposterior roentgenogram is made with the patient supine, the lower extremities extended, and the medial aspects of both feet in apposition, stabilized with sand bags. The tube is placed over the abdomen so that the central ray is projected through the intersection point of the sagittal plane passing through the centers of the acetabula.

For lateral views, the position of the tube remains unchanged; a cassette of the same size is used and is placed in the same position as for the anteroposterior view. The patient remains supine but the lower extremities are placed in the "frog-leg" position, that is, the hips are flexed, abducted, and externally rotated, the knees are flexed, and the soles of the feet are in complete apposition. Both projections are made with both hips shown on each film. Thus, in unilateral cases, comparison of the suspected with the contralateral hip is possible.

With bilateral involvement, however, where there is no "normal" hip for comparison, the early phase of slipping may go unrecognized. For this reason, a series of roentgenograms of normal hips, both male and female, from birth to maturity were assembled to serve as a standard for comparison in cases in which epiphyseal slipping is suspected. The authors believe that this series provides a good working basis for detecting slight deviations.

The authors describe in detail the roentgenographic characteristics of "normal" hips. The roentgenographic characteristics of slipped epiphyses are also described in detail. Lateral roentgenograms of epiphyses in the early stage of slipping disclosed posterior or backward displacement of the head in 80 per cent of cases, straightening of the anterior neck line in 69 per cent and periosteal proliferation at the junction of the head and neck line in 79 per cent. In the early stage of slipping, the authors believe it is not always possible to make a diagnosis from a single roentgenogram. They regard it as only possible by an appreciation of the positive changes noted in a comparison of both the anteroposterior and lateral views with "normal" roentgenograms which will make the diagnosis evident. Their meticulous study did not disclose any instances of so-called "preslipping" stage. When, upon examination of one view, it appeared that such a situation existed, the other projection invariably also demonstrated some degree of slipping.

In the later phase of slipping, the neck was found to be shorter and broader on the involved side in 86 per cent of cases. The neck contour lost its concavity proximally on its superior and anterior aspects in 94 per cent. The proximal part of the neck at its junction with the epiphysis was left bare superiorly and anteriorly over an area equivalent to the amount of slipping. Atrophic changes appeared in this region, first as decalcification, later as a molding of the neck to adapt itself to the new position of the head. At the inferior and posterior aspects of the head and neck junction overgrowth of bone occurred which, together with the projection of the displaced head, formed a "crow's beak." Obvious descent of the head toward the lesser trochanter was considered another criterion of marked slipping. Slipping was found to be posterior or at times medial.

The authors believe detection of early slipping permits the simplest satisfactory form of treatment, namely, nailing in situ. Periodic roentgen examination is necessary after nailing, at bimonthly intervals at least. Roentgenograms taken at such intervals by the authors' technique will disclose growth of the head away from the neck and the nail, should it occur, and also any change in position of the nail, or any reaction about the nail, whether it be proliferative or absorptive. Also in unilateral cases, it may reveal early slipping in the contralateral hip. Follow-up examinations should continue until the epiphyses on both sides have fused.—*Ralph S. Bromer, M.D.*

Robinson, Robert F. and Kayfetz, Daniel O. Arthrodesis of the wrist; preliminary report of a new method. *J. Bone & Joint Surg.*, Jan., 1952, *34-A*, 64–70.

The authors devised a new method of arthrodesis of the wrist to obtain rapid and certain fusion with a

minimal loss of time and earning capacity and to attain and maintain a precise positioning of the hand. Their procedure consists essentially in resection of the proximal row of carpal bones, with fixation of the capitate to the radius by means of a screw. This has the advantages of apposing cancellous bones, with an intact blood supply, with positive internal fixation. Healing is not dependent upon any grafted bone. Two cases are reported in detail with serial roentgenograms showing end results. The operation is recommended for routine fusions in non-tuberculous cases. It is preferred to arthroplasty because of the stability, freedom from pain and the relatively slight disability which results.—*Ralph S. Bromer, M.D.*

MILLER, ALEXANDER, and FRIEDMAN, BARRY. Fascial arthroplasty of the knee. *J. Bone & Joint Surg.*, Jan., 1952, *34-A*, 55–63.

This paper is based on the study of 37 arthroplasties of the knee. The period of postoperative follow-up ranged from three to fifteen years. No operative deaths occurred in the series. There were 11 good results (30 per cent); 8 fair results (22 per cent); and 18 failures (48 per cent).

Patients with polyarticular ankylosis resulting from atrophic arthritis proved to be particularly poor candidates for arthroplasty. Ankylosis due to extension of an osteomyelitic process about the knee joint gave similarly poor results. The most favorable results from the operation were obtained in cases where the knee joint was involved secondarily by a blood-borne infection.

Causes of failure are analyzed and operative techniques are discussed in the paper and roentgenograms are shown demonstrating results in several cases. From their analysis of the cases, the authors believe it is apparent that a new joint of sufficient mobility and stability, with freedom from pain, is not a constant result. However, the unusual benefits derived from a successfully mobilized knee make the operation of arthroplasty of great value in the carefully selected cases of ankylosis. The operation should be advised only after the patient has been made aware of its limitations.—*Ralph S. Bromer, M.D.*

ROGERS, JAMES D., and BICKEL, WILLIAM H. An unusual form of osteo-arthropathy present bilaterally in the knees of two brothers. *J. Bone & Joint Surg.*, Jan., 1952, *34-A*, 135–143.

The 2 cases reported in this paper are considered by the authors to be sufficiently unusual and perplexing from the standpoints of etiology and diagnosis to justify a record being made of them. For lack of a classifying name, they suggest the term "osteo-arthropathy." In the first case, roentgen examination revealed epiphyseal arrest of the lateral border of the femoral condyles with marked roughening and some fragmentation of the epiphyses in the left knee. The right knee exhibited marked effusion with some anteroposterior and lateral instability and slight limitation of flexion. In the second patient, roentgenograms of the right knee showed evidence of a fragmentation of the lateral femoral condyle with one large displaced fragment and in the left knee similar fragmentation but with no displaced fragment. Both patients were operated upon.

The authors comment that it was difficult to determine whether or not the entity, which they describe fully, should be called "osteochondritis dissecans," "chondromalacia of the knee joint" or "chondrodystrophy of the knee joint." They regard it as certain, however, that some pathological process was developing which prohibited the cartilage on the femoral condyles of the boys from maturing in normal fashion. The operations on the knees disclosed the fact that nearly the whole cartilaginous surface of the lateral femoral condyle was loose, including some of the subchondral bone. This subchondral bone was granular and the defect extended deep into the femoral condyles. It is rare in osteochondritis dissecans of the knees to have such great defects that osteotomy of the femur is necessary to correct the valgus deformity.

It is unusual that the condition was bilateral and that it occurred in two brothers. The authors are watching with great interest a third brother, inasmuch as they are suspicious that in him the same process is in its incipient stage.—*Ralph S. Bromer, M.D.*

VARE, VICTOR B., JR. The anatomy of the pelvic tear figure. *J. Bone & Joint Surg.*, Jan., 1952, *34-A*, 167–169.

The pelvic tear figure or "tear drop" is a roentgenographic landmark seen in the anteroposterior view of the pelvis. Vare used a method of trial and error with metal markers to locate the structure causing this shadow. He concludes that the lateral border of the pelvic tear drop is made up of the cortical surface of the middle third of the acetabular fossa, commencing at the lunate surface proximally and extending to the cotyloid notch inferiorly. Continuation through the obturator foramen marks the inferior aspect of the roentgenographic structure. The medial aspect of the tear figure is made up of the cortical surface in the true pelvis, where a groove for the obturator vessels and nerve exists, continuing in the same plane as far as the arcuate line immediately posterior to the iliopectineal prominence. The figure is demonstrated in reproduction of roentgenograms and photographs of dried specimens.

The relationship of the tear drop and the adjacent structures is remarkably constant under normal circumstances. Alteration of this relationship, however slight, especially when compared with the opposite side, suggests pathological changes either in the pelvic bones in the vicinity or in structures which make up the hip joint in general.—*Ralph S. Bromer, M.D.*

Arkin, Alvin M. Prophylaxis of scoliosis. *J. Bone & Joint Surg.*, Jan., 1952, *34-A*, 47–54.

Arkin concludes in this paper that gravity acting upon a growing spine which is not straight can produce structural scoliosis due to pressure-arrest of epiphyseal growth. In a straight spine the superincumbent weight falls equally on each side of the growing vertebral plate. In a curved spine the superincumbent weight falls unequally on each side of the growing vertebral body. More pressure falls upon the side in the concavity of the curve. Hence growth on this side will be inhibited. The end result of unequal pressure is unequal growth—structural (wedged) scoliosis.

He therefore regards the early recognition and treatment of functional curvatures of primary importance in the prophylaxis of structural scoliosis. Certain common types of functional curvatures can be corrected by tilting the pelvis by shoe and buttocks lifts, thus preventing progression into structural scoliosis.

Roentgenograms are shown demonstrating correction of functional curves with end results showing no structural scoliosis and normal alignment. He mentions the possibility that similar methods may prove useful in correcting the actual wedged vertebrae of structural scoliosis by what may be called "piezo-equalization" of vertebral growth. Selected cases of this sort are now under treatment and will be reported in a later article.—*Ralph S. Bromer, M.D.*

Overton, Lewis M., and Grossman, J. W. Anatomical variations in the articulations between the second and third cervical vertebrae. *J. Bone & Joint Surg.*, Jan., 1952, *34-A* 155–161.

The anatomy of the cervical vertebrae allows free flexion, extension, and lateral motion, but it allows only slight rotation. Rotation takes place almost entirely in the first two cervical joints. Thus variations in the apophyseal articulations of any of the cervical vertebrae will produce irregular motion and, at times, a definite instability of the joint involved. The study of 36 cadaver specimens presented in this paper indicates, according to the authors' opinion, that these variations are not infrequent and that they are confined to articulations between the second and third cervical vertebrae. A full description of the variations found is given, and they are illustrated by line drawings. The variations studied were revealed by roentgenograms.

The findings of the authors leads them to believe that they tend to confirm the hypothesis that irritation of the third cervical nerve does produce occipital headaches. These findings may offer a partial solution to the problem of headaches which frequently accompany symptoms referable to the upper portion of the cervical spine as described by Josey. Injury or chronic strain to these articulations may produce capsular ligament irritation and edema.—*Ralph S. Bromer, M.D.*

Hadley, Lee A. Accessory sacro-iliac articulations. *J. Bone. & Joint Surg.*, Jan., 1952, *34-A*, 149–155.

This paper is a report of the study of a group of anatomical specimens consisting of 185 half sacra and 163 ilia which were dissected and roentgenograms of these specimens were compared with those of 200 consecutive private patients. Two types of accessory sacroiliac articulations were identified. The more common superficial accessory joint is seen between the posterior superior iliac spine and the lateral crest of the sacrum opposite the second posterior sacral foramen. Prominent facets surmounted by articular cartilage develop at these points.

The deep articulation, less frequently observed, develops between the large roughened tuberosity of the ilium and the smaller sacral tuberosity. It is found opposite the first sacral foramen. These movable diarthrodial joints may become arthritic and even ankylosed. Hadley regards them as compatible with symptoms of low-back pain and sciatica.—*Ralph S. Bromer, M.D.*

Schreiber, Frederic, and Haddad, Benjamin. Lumbar and sacral cysts causing pain. *J. Neurosurg.*, Sept., 1951, *8*, 504–509.

The authors have noted that about 1 per cent of their cases operated upon for a low lumbar disc rupture had a lumbar or sacral cyst consisting of a fluid-filled swelling either within the nerve or arising from the dura as a meningocele. These cysts compressed the cauda or a nerve tract emerging from the dura.

Two earlier cases are referred to in which cysts were found but 3 cases are described in detail which they believe throw light on the development of these cysts.

In the first case the patient five days previously experienced excruciating pain in the back and left leg while bending over. The left ankle jerk was absent and the leg could not be raised because of pain; hypesthesia was present over the left first sacral nerve distribution. Surgery did not reveal a herniated nucleus. The 5th lumbar lamina was, however, markedly mobile and the 1st sacral nerve covered with granulation tissue and markedly swollen just below the upper edge of the sacrum. The appearance suggested trauma, possibly associated with the abnormally mobile 5th lumbar lamina. The sacrum was unroofed over the lumbar lamina and the patient became free of pain postoperatively.

In the second case the patient, a female, gave a history of a fall some years previously; since then she had had episodes of moderate low back pain. Just before admission she had an attack of severe low back and left leg pain. Both ankle jerks were

present and there was hypesthesia over the first sacral distribution on the left. Myelograms revealed an almost complete block at the 4th lumbar level. At surgery the 4th and 5th laminae were removed and the dura opened. A soft mass was found compressing the cauda extradurally in the 5th lumbar nerve. The nerve was sectioned above and below the swelling and the mass was removed. Section revealed the mass to consist of a hemorrhage into the nerve. The patient was completely relieved of pain.

In the third case the patient had a history of back and left leg pain for twenty years. He had been in an automobile collision eighteen months previously which was followed by incapacitation by the low back and left leg pain. Neurological findings suggested a herniated nucleus at the 5th lumbar level on the left side. At surgery the left 4th and 5th lumbar laminae and the left upper sacrum were exposed and a laterally placed nucleus was removed from the left 4th space, the patient being relieved of the leg pain. Six weeks later she began to complain of pain along the right thigh and leg, with difficulty in emptying the bladder. These symptoms became progressively more severe during the next year when there occurred complete urinary retention. Raising either leg produced pain. The knee and ankle jerks were normal. An area of hypesthesia was found laterally over the right thigh. Myelograms revealed a collection of pantopaque beneath the upper sacrum on the right side. The myelograms taken at the previous admission had also shown this collection of pantopaque. The sacrum overlying the opaque medium now appeared thinner than at the previous examination. Surgery revealed a paper-thin bulging 2.5 cm. in diameter in the upper right sacrum with a cyst 3 cm. in diameter in the 2nd sacral nerve. The cyst was irrigated and found to contain clear fluid except for flecks of pantopaque. The wall of the cyst was very thin and consisted of neural tissue and nerve sheath. It was not removed because of fear of disturbing further the bladder function. After surgery the pain was relieved and bladder function became normal.

The authors feel that these 3 cases may represent the sequence in the formation of these cysts, this being (1) nerve trauma, (2) intraneural hemorrhage and (3) intraneural cyst.

One of the authors had earlier reported another type of lumbar cyst which is epidural but communicates with the subarachnoid space, for which surgery had not been done previously. A more common lesion of this type occurs postoperatively. If the dura is nicked inadvertently an immediate bulging of the arachnoid through the dural defect occurs and remains as a meningocele if the dural defect is not closed with a suture. A case is reported in which a large herniated nucleus was removed at the left lumbosacral space and the symptoms typical of first sacral nerve compression entirely disappeared. Two years later a similar recurrence was observed on the right side and a herniated nucleus removed. The nerve sheath was torn in tearing the nerve away from the underlying protrusion. The patient was free of pain until readmission nine months later. The myelogram then revealed a collection of pantopaque in a cyst at the right lumbosacral level. The cyst was removed and had the histopathological character of a meningocele. Pain has not recurred. The cyst was not present at the first operation and the authors believe it to be the result of the nerve sheath damage.—*J. Paul Bennett, M.D.*

VAN DEMARK, ROBERT E. Osteochondritis dissecans with spontaneous healing. *J. Bone & Joint Surg.*, Jan., 1952, *34-A*, 143–148.

In certain of the outstanding textbooks of orthopedic surgery, it is stated that watchful waiting until the undisplaced fragment in osteochondritis dissecans is extruded into the joint is neither necessary nor desirable. This statement is generally true for adults, notwithstanding the fact that revascularization of the undisplaced fragment has long been known. The author believes the cases which he reports in this paper illustrate that surgery is frequently unnecessary. Normal knees were obtained through conservative treatment and were demonstrated on clinical and roentgenographic examination.

As with Legg-Perthes disease, the revascularization of an undisplaced fragment in osteochondritis dissecans of the knee in children appears to proceed with reasonable rapidity in certain cases, provided the joint is protected from weight bearing. The roentgenographic findings in the 2 cases reported, suggest that, in children, treatment in which weight bearing is not allowed should be adopted for a period of at least six months. Surgery is reserved only for those cases in which clinical and roentgenographic improvement cannot be demonstrated or in which displacement occurs.—*Ralph S. Bromer, M.D.*

BLANCHE, DONALD W. Osteomyelitis in infants. *J. Bone & Joint Surg.*, Jan., 1952, *34-A*, 71–84.

The author states that the incidence and severity of acute hematogenous osteomyelitis have decreased strikingly in the past fifteen years, first because there is a better knowledge of general treatment of the sick child, and second because of the development of antibiotics. However, as the incidence in infants under the age of one year has not decreased, the disease in the infant is relatively more common and more important than in former years. His purpose in the paper is to point out the shift in age incidence of acute hematogenous osteomyelitis to the younger group, to discuss the problem of early diagnosis, to call attention to the crippling deformities which occur in infancy, and to try to determine what changes in present methods of treatment will diminish this disability.

In a series of 64 cases previously reported from

the author's hospital, the greatest incidence was at the age of ten years, and only 1 patient was under one year of age. In Blanche's present series of 35 cases the greatest incidence is now in the age group of less than one year. The shift in age incidence may be due first to the common use of antibiotics in treatment of primary infections in older children, and second, to the lack of resistance of the newborn to pyogenic infections.

Acute hematogenous osteomyelitis in infants runs a rapid course. The correct diagnosis is often made late, after irreparable damage to joint components and growth centers has occurred. Normal temperature and absence of general reaction to infection are often misleading. The disease should be suspected if an infant becomes irritable and if swelling, tenderness, or loss of function of an extremity develop.

The intra-articular tension and lytic action of pyogenic exudate in pyoarthrosis of the hip rapidly destroy cartilage, thus causing disruption of the joint, pathological dislocation and serious growth disturbances which result in severe crippling. In those dislocated hips which were later observed at open operation, it was found that internal rotation was necessary to place the remaining elements of the proximal end of the femur into the acetabulum.

There is little controversy concerning the general treatment of the sick infant, but the present tendency is to pay too little attention to the local bone and joint lesion. The chief fault in the present-day treatment, according to the author, is the tardiness of surgical drainage of localized abscesses, particularly when a hip joint is involved. Study of his series suggests that early surgical drainage, followed by traction in abduction and particularly with internal rotation, would have minimized absorption of cartilage and saved some of these hips.

Serial roentgenograms of four cases are reproduced.—*Ralph S. Bromer, M.D.*

Slepian, Alexander, and Hamby, Wallace B. Neurologic complications associated with hereditary deforming chondrodysplasia; review of the literature and a report of two cases occurring in the same family. *J. Neurosurg.*, Sept., 1951, *8*, 529–535.

The authors describe hereditary deforming chondrodysplasia as a congenital abnormality of osteochondral development, resulting in irregularity and arrest in growth at the metaphyseal ends of the long bones causing deformity and the occurrence of multiple cartilaginous masses which with calcification become osteocartilaginous. Among other names given the condition are: multiple cartilaginous exostoses, dyschondroplasia and diaphyseal aclasia.

The anomaly must be differentiated from (1) achondroplasia (chondrodystrophia fetalis), (2) Morquio's syndrome, (3) Maffucci's syndrome, (4) Ollier's disease, and (5) single exostosis.

Approximately 1,000 cases have been reported. Neurologic complications have been rare. The authors found 11 cases in the literature in which they felt that either the findings did not support the diagnosis of hereditary deforming dyschondroplasia or in which the neurologic disturbance suggested an unrelated associated disease. In 19 of the cases reported the neurologic complication was directly related to an encroaching osteochondral exostosis. In 14 of 15 of these cases, in which the sex was mentioned, the male sex was affected. The spinal cord was involved in 10 cases, the sciatic nerve in 6, the peroneal in 2 and the brachial plexus and ulnar nerve in 1 each.

Because of the rarity of neurologic complications associated with the condition, the authors present 2 additional cases in which the etiology was proved and which occurred in the same family.

The first case was that of a thirty-five year old male complaining of paresthesias of the left third and fourth fingers persisting for ten months, followed by numbness of the hand, progressive weakness of the fingers and forearm and impaired dexterity. During the previous seven months, he had noted a descending loss of sensation of the right lower extremity, urgency, frequency, and dribbling of the urine with suprapubic discomfort. Examination revealed multiple skeletal deformities. A large irregular mass was palpable in the left cervical area and a second in the left upper arm, with smaller masses in two of the ribs and another in the left posterior tibial region. There was atrophy of the muscles of the left arm and of the right lower extremity. The left forearm was shorter than the right. There were positive neurologic findings, consisting of sensory changes in the right and pyramidal tract signs in the left, suggestive of incomplete Brown-Séquard syndrome at the C5 level. Roentgenograms revealed multiple broad-based osteochondromas most evident in the left femur and over the fifth and sixth cervical vertebrae. A spinogram demonstrated a complete subarachnoid block at C6. A laminectomy at the C5-C6 level showed the vertebral canal to be narrowed in the anteroposterior diameter; the dura was elevated and displaced to the right by a grumous bone tumor. The intervertebral portion of the tumor was excised but the paravertebral extension was too massive for removal. Histopathological examination revealed a lobulated mass of hyaline cartilage with myxomatous degeneration in many areas. The patient improved subjectively but at discharge twelve days later the neurologic status was unchanged. He has remained asymptomatic except for some shoulder pain.

The second case was that of a thirty-seven year old man, brother of the first case, who had suffered paresthesias and cramping in the left posterior thigh with recurrent attacks of sciatic pain. Examination revealed a large palpable mass over the left femur. The roentgenogram showed a diffuse widening of the lower femoral shaft with a large cauliflower-like osteochondroma of the upper femur at the lesser

trochanter. Similar widening of the upper and lower shafts was noted in the forearms and legs with shortening of the forearms and multiple osteochondromas. The nodular femoral osteochondromas were removed and found to have a thick cap of hyaline cartilage covered by a thick fibrous perichondrium. Many areas of mucoid degeneration were seen in the cartilage. There was complete relief of the paresthesias and pain. In this case roentgenograms also gave evidence of the lesion in two sons.—*J. Paul Bennett, M.D.*

ROECKRATH, WOLFGANG. Hereditäre Osteo-onycho-Dysplasie. (Hereditary osteo-onycho-dysplasia.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Dec., 1951, *75*, 700–712.

The author claims the credit for gathering into a unitary concept what was formerly considered a number of isolated anomalies. The condition is dominant, non-sex-linked, manifested by usually symmetrical anomalies of mesodermal and ectodermal derivatives, such as dysplasias of a number of the bones and joints, associated with dystrophies of the nails, and anomalies of pigmentation of the iris. Some functional limitation may or may not be present, but no lethal variants have, as yet, been described.

The following findings occur with diminishing frequency: (1) *Dysplasias of the Pelvic Girdle.* (a) Iliac horns (Fong's sign), symmetrical excrescences on the dorsal surface of each ilium, about 2 or 3 cm. lateral to the middle of the sacroiliac joint, and about 1 to 4 cm. high. (b) Hypoplasia of the ilia, between the acetabula and the crests, so that the crests are more prominent than usual and the anterior and posterior superior iliac spines may become proboscis-like projections. (c) Bowed sacrum with hyperlordosis of the lumbar spine. (d) Bilateral protrusio acetabuli, so that the silhouette of the pelvis is like that of a conventional heart. (e) Coxae valgae. (2) *Dysplasias of the Knee Joints.* (a) Absence or hypoplasia of the patellae, with a tendency to lateral dislocation. If developed, the patellae may be crumbly, malacic, or unusually dense during the growth period. (b) Hyperplasia of the internal condyle of the femur. If marked, a hypoplastic, laterally dislocated patella may be obscured by the overlying hyperplastic internal femoral condyle in the lateral view, and may be demonstrable only in an axial view. (c) Hypoplasia of the fibular head, with stunting of the tibiofibular joint. (3) *Nail Dysplasias.* The thumbnails are most constantly involved, next, those of the index fingers, while the others are only occasionally affected. The toenails are almost always normal. The nails may be completely absent, or partially so and longitudinally grooved, flat, or even concave. They grow very slowly, tend to splinter, and are difficult to keep clean. Sensation in the fingertips is also disturbed, interfering with the use of the thumb and index finger in delicate work. (4) *Anomalies of Pigmentation of the Iris* (*Lester's sign*). The darker pupillary border, usually just about 1 mm. wide, is markedly and irregularly widened. It is seen best in blue eyes. (5) *Dysplasias of the Elbow.* (a) Hyperplasia of the ulnar epicondyle of the humerus, and hypoplasia of the capitulum. (b) Hypoplasia or agenesis of the radial head, producing dislocations, usually posterior, but also anterior and lateral, and interfering with mobility of the elbow joint.

The list above contains the major anomalies, but the following are also found, sometimes as isolated abnormalities: (6) *Foot Dysplasias.* (a) Hypertrophy of the malleoli, the external more frequently than the internal. (b) Club feet or flat feet. (7) *Arm and Hand Dysplasias.* (a) Madelung's deformity with dislocation of the lunate. (b) Hypertrophy of the styloid process of the ulna. (c) The hand may be more plump than usual; the index finger may be as long as or longer than the ring finger; the little finger may be markedly shortened and in a position of clino- or camptodactyly; there may be hyperflexibility of the fingers. (8) *Shoulder Girdle Dysplasias.* (a) Hypoplasia of the scapula with a thickened convex axillary border. Diminutive coracoid and acromion processes. (b) Tendency to dislocation and fracture of the clavicle. (c) Flattening of the humeral head and bicipital sulcus. (9) *Hyperostosis of the Frontal Bone.*

The ribs and vertebrae appear to be spared, vertebral anomalies being no more frequent than in the general population.

These patients have a tendency to early development of arthrotic changes in the abnormal joints, and to get osteochondritis dissecans and rickets. The teeth wear rapidly and dentures are needed at an early age. In many cases the teeth erupt late.

On the genetic side of the problem, some feel that the dominant hereditary nature of the dysplasia is undoubted, and that the sole question is whether the mechanism is polyphany or polygeny, with or without coupling. Others believe that the mechanism is not hereditary but the result of overpowering environmental factors during the developmental period, because of sporadic cases observed. The author feels that the mechanism is hereditary, polygenic in nature, owing to the large variety of manifestations. He explains the variations in the clinical picture, and sporadic cases, as a manifestation of variations in penetrance, specificity, and expressivity of the genes. He thinks the fact that derivatives of several germ layers are involved in the process does not preclude the unitary nature of the disease, citing similar cases among other hereditary syndromes.—*John J. B. Light, M.D.*

KESTERSON, JOHN, and MCSWAIN, BARTON. Myeloma of bone. *J. Bone & Joint Surg.*, Jan., 1952, *34-A*, 224–228.

This paper is an analysis of 14 cases of microscopically proved myeloma of bone together with the

report of a case of a patient who was still alive nine years after the diagnosis of myeloma had been made. The 14 cases of myeloma composed 6 per cent of all bone tumors and 20 per cent of malignant bone tumors.

The patient, who lived nine years and five months after the diagnosis of myeloma had been made, was treated by roentgen therapy at various times during that interval. Approximately one year before his death, roentgenograms revealed extensive destructive lesions in the ribs, femora, skull, clavicles, scapulae, humeri, pelvis, right acromion, and bodies of the fifth cervical, sixth and seventh thoracic and fourth lumbar vertebrae, and the sacrum.—*Ralph S. Bromer, M.D.*

Smith, Edward B., Hempelmann, Theodore C., Moore, Sherwood, and Barr, David P. Gargoylism (dysostosis multiplex); two adult cases with one autopsy. *Ann. Int. Med.*, Feb., 1952, *36*, 652–667.

Two cases of gargoylism (dysostosis multiplex), somewhat unusual in that both reached adult age, are discussed, and the usual clinical findings and course reviewed.

Characteristic roentgen findings are present, particularly in the skull, and appear secondary to abnormal bone growth and sutural and epiphyseal union. Early fusion of the lambdoid and sagittal sutures with continued growth in the anterior and lateral aspect of the skull results in dolichocephaly, hypertelorism, and frontal and temporal bossing. The sellar changes, thought to be virtually diagnostic, consist of anteroposterior elongation with a distinct anterior pocket beneath the anterior clinoids. Some increase in vertical diameter may be present but no thinning or erosion is evident.

Skeletal dwarfism and flexion deformities of the joints are characteristic and are secondary to disturbance in the diaphyso-epiphyseal line. While epiphyseal ossification appears normally, union is delayed. Other skeletal changes include spinal shortening and lower dorsal or lumbar kyphos, large hands, and bowing of long bones. Roentgen examination may also reveal the typical protuberant abdomen, with enlarged spleen and liver, and frequent umbilical hernia.

Biochemical and pathological studies in these cases, including postmortem examination in one and liver biopsy in the other, indicate that the basic defect in this disease involves dysmetabolism of glycogen or an associated macromolecular substance. No elevation of serum or liver lipids was found, while histological studies demonstrated increased glycogen-like substance in liver, and to a lesser extent in pituitary, adrenal medulla, and bone marrow. —*William C. MacCarty, M.D.*

Holt, John F., and Dickerson, Willard W. The osseous lesions of tuberous sclerosis. *Radiology*, Jan., 1952, *58*, 1–8.

Tuberous sclerosis is one of a group of closely related congenital malformations which affect primarily ectodermal structures but which may also present abnormalities in structures of mesodermal and, to a lesser degree, endodermal origin. This group of congenital malformations includes (1) Recklinghausen's neurofibromatosis, (2) Bourneville's tuberous sclerosis and (3) Sturge-Weber cephalotrigeminal angiomatosis. Each of these diseases has fairly characteristic roentgenologic signs seen best in the osseous system.

Tuberous sclerosis gets its name from the potato-like nodules occurring in the brain substance which constitute the basic pathologic lesions in the disease. Any of these nodules may calcify, particularly those in and about the basal ganglia. Clinically, patients with classical tuberous sclerosis present the triad of facial adenoma sebaceum, mental deficiency, and convulsions. Retinal and renal tumors are also frequently seen as in the other congenital ectodermoses.

The authors present their roentgen findings in a series of 43 cases of tuberous sclerosis. Calcification in the region of the basal ganglia was seen in at least 50 per cent of these patients. Abnormal islands of sclerotic bone in the cranial vault were seen in 40 per cent. Frequently these areas had been previously interpreted as representing foci of intracranial calcification, their actual location in the cranial vault not being recognized. Sixty-six per cent of this group had definite roentgenologic changes of the hands and/or feet that the authors feel represent a fairly diagnostic roentgen appearance. These changes consist of localized cyst-like areas of bone destruction in the phalanges and/or wavy periosteal new bone formation along the shafts of the metatarsals and metacarpals. The cyst-like areas, in general, are not sharply circumscribed or "punched out," but rather seem to be formed by slowly progressive rearrangement of the trabeculae, which, in turn, may coalesce, producing a "smeared" sclerotic appearance. It appears that these areas are not present at birth but may appear relatively early in childhood.

No defects were found in the spine and long bones as are observed in neurofibromatosis. The differential diagnosis of the cyst-like lesions should include the osseous lesions of sarcoidosis and the degenerative cyst-like lesions associated with the chronic arthritides. In sarcoidosis there is a characteristic fine reticular pattern of bone destruction which is not found in tuberous sclerosis; there is less distortion of the general trabecular pattern in localized sarcoid lesions and there is almost never an associated periosteal thickening. The cranial abnormalities do not ordinarily occur in sarcoidosis. In the chronic arthritides there will be associated joint changes. The localized or irregular wavy periosteal new bone formation of tuberous sclerosis should be fairly easily differentiated from the diffuse, uniform reactive periosteal new bone formation of the metatarsals seen in patients with localized disorders of the feet due to arch defects, faulty weight-bearing, etc.

One must also rule out low grade inflammatory lesions of the metatarsals, and the callus formation in the so-called march fractures.—*D. N. Dysart, M.D.*

Johanning, Kurt. Coxa vara infantum. I. Clinical appearance and aetiological problems. *Acta orthop. Scandinav.*, 1951, *21*, 273–299.

The normal development of the skeletal and muscular systems depends on normal use of muscles and joints. Even when our small patients do not always experience any subjective discomfort of importance, they instinctively perceive the failing stability of the affected hip, and they will from the outset try to spare the diseased limb with the result that the whole of this region lags behind in its normal development.

We may differentiate between five groups of non-inflammatory conditions in the caput-collum region, all presenting the above mentioned features, though not always easily distinguishable. These groups are as follows:

(1) Congenital defect of the upper end of the femur.
(2) Coxa vara infantum.
(3) Coxa plana (Legg-Calvé-Perthes).
(4) Coxa vara adolescentium (epiphyseolysis colli femoris).
(5) Coxa vara, either primary or secondary, associated with various other conditions. The synonyms of coxa vara infantum are: coxa vara congenita; developmental coxa vara; coxa vara.

The clinical picture varies; most of the children are well developed at birth but show signs of tiring easily when beginning to walk. They soon start limping and in the bilateral cases, they develop a characteristic, waddling gait reminiscent of dislocation of the hip. At first there is no upward displacement of the trochanter and the head of the femur is palpated in its proper place. The symptoms gradually increase so that at puberty instability of the hips is considerable and upward displacement of the trochanter is measurable, a shortening of the limb of 9–10 cm. being common. Back symptoms are common when the affected limb is shortened.

The author has examined a series of 42 patients, with a total of 55 hips, suffering from coxa vara infantum.

The series is classified in three age groups:

(I) Patients under 10 years.
(II) Patients between 10 and 15 years.
(III) Patients over 15 years.

The sex distribution of the disease was found to be approximately even, and its incidence in Norway is calculated as being at least 1:25,000 live births.

The disease was bilateral in 13 cases. Spontaneous recovery is very rare, and as a rule matters become steadily worse from early childhood to the completion of puberty, by which time a complete pseudarthrosis has developed between caput and collum. Legg-Calvé-Perthes disease was found in seven hips, in 4 cases in combination with coxa vara.

The diagnosis depends on the changes seen in the roentgenogram and the findings vary greatly according to the stage of the development of the disease, at the time the patient is first examined.

In the early age group the epiphyseal line may be steep, varying from 75 to 90 degrees in most cases. In age group II, the most conspicuous feature was the slipping of the head, which has become more marked, and in the cases in which the head has not found support against the neck or the lesser trochanter it was found far down along the shaft of the femur. In group III there was marked slipping of the caput femoris and in most of these cases there was a complete interruption between the head and neck or a definite pseudarthrosis.

Epiphyseolysis capitis femoris was found in 4 cases, always on the coxa vara side.

The changes were so far-reaching in four hips that the condition was transitional to hypoplasia of the upper end of the femur. One patient presented coxa vara on one side and marked hypoplasia of the upper end of the femur on the other side.

In 4 cases there was a history of severe trauma to the hip, but in only 1 of these cases was a single severe trauma quite obviously responsible for the genesis of the disease. The author emphasizes the importance of trauma as a contributory etiological factor. When there is a moderate degree of irregularity in the process of ossification in the collum metaphysis, the strain entailed by the daily use of the hip may start a vicious circle and prevent the normal development of the collum support for the caput epiphysis. In the opinion of the author, the good results achieved by the operative readjustment of the epiphyseal line give support to the theory that traumatic factors are of importance to development of the disease and its subsequent course.

The transition to genuine hypoplasia of the upper end of the femur is floating. The comparative frequency with which Legg-Calvé-Perthes disease and coxa vara infantum occur in one and the same patient suggests the possibility of a genetic factor common to both.

Heredity and association with several developmental anomalies have been found. The author concludes that etiologically we have to regard the interplay of several factors as being responsible for the genesis of coxa vara infantum.—*Robert K. Arbuckle, M.D.*

Paus, Bernhard. Madelung's deformity; its etiology and pathogenesis. *Acta orthop. Scandinav.*, 1951, *21*, 249–258.

Madelung's deformity may be *genuine* or *symptomatic*. The genuine form is supposed to be caused by (a) rachitis, (b) constantly recurring injury, for instance because of heavy work, or (c) heredity.

The symptomatic form may arise after fracture or disease of the lower end of the radius.

Heredity or familial occurrence is mentioned in about 40 per cent of the cases published. Recurrence throughout three generations has been reported in several cases.

The present paper reports 30 cases of Madelung's deformity occurring in the course of six generations in one family. The deformity appeared only when it was also present in one of the parents. The cause of the deformity seems to be a dominant, autosomal, nonsex-linked hereditary factor.

The pathogenesis is apparently a reduction of growth in the entire distal epiphyseal disc of the radius, but especially in its volar-ulnar part. The cause is not a premature fusion of this part, as the deformity is clearly seen even when the entire disc is open. The angular deformity of the proximal carpal row is secondary to the changes in the radius.

In the present material the deformity has already been found in full course of development at the age of six years. The deformity is accompanied by a general restriction of growth.—*Robert K. Arbuckle, M.D.*

Naz, John F., and Edwards, Walton M. Hypervitaminosis A; a case report. *New England J. Med.*, Jan 17, 1952, *246*, 87–89.

This is a case report of a nine month old girl with clinical findings of irritability, pruritus, anorexia, constipation, alopecia, dry cracked lips, maculopapular rash, tenderness of extremities and hepatomegaly. There was a history of ingestion of "8 dropper-fuls" of oleum-percomorphum and the serum vitamin A content was 1,121 I.U. Periosteal reaction and hyperostoses were found in the skull, clavicle, ulnas, fibulas, ribs and all but the 1st metatarsals. There was epiphyseal cupping of the ends of several bones. Fairly prompt disappearance of symptoms and slow regression of bone changes followed withdrawal of the vitamin.

The child had been on overdosage of oleum-percomorphum since the age of two weeks but symptoms definitely referable to hypervitaminosis A were not manifest until approximately six months of age. Although the diagnosis was not made until at the age of nine months, there was evidence of hyperostoses on films taken three months before.

The authors feel that faulty excretion of the vitamin A may be contributory.—*C. E. Sherwood, M.D.*

McCormack, Lawrence J., Dockerty, Malcolm B., and Ghormley, Ralph K. Ewing's sarcoma. *Cancer*, Jan., 1952, *5*, 85–99.

The authors reviewed all the cases at the Mayo Clinic in which a diagnosis of Ewing's tumor or any of its synonyms was made from 1907 through 1949. To these cases were added an additional 50 cases of unclassified malignant lesions of bone and more than 350 cases of osteogenic sarcoma. This made a total of more than 500 cases. Microscopic sections were examined from all specimens and from this large group of tumors, 80 were selected in which the correct diagnosis seemed to be Ewing's sarcoma. Clinical records and available roentgenograms were then reviewed in order to complete a predominantly pathological study.

The following conclusions were made:

(1) Ewing's sarcoma is a definite pathological entity.

(2) Basically, Ewing's sarcoma forms nothing but cells arranged in sheets and nests separated by a finely vascularized stroma which negates any attempts to derive histogenesis. The cells themselves are essentially naked nuclei since cytoplasm is rarely recognized. The nuclei are round to oval and regular in size and shape. The regularity in size and the homogeneous appearance are of great importance. The absence of spindle cells, multinucleated cells and tumor giant cells is equally important.

(3) The patients were young, 85 per cent being less than thirty years of age. The male sex predominated slightly. The complaints were pain and swelling.

(4) Roentgenographic findings were of four basic patterns: (a) mottled lysis, (b) sclerosis, (c) cystic loculation and (d) periosteal reaction. The laminated deposits commonly thought to be characteristic of this disease were only occasionally seen.

(5) Macroscopically the neoplasm was a pear-shaped symmetrical tumor located in the metaphysis of the bone. It tended to seed along the marrow cavity, to invade vascular spaces (31 per cent), and to spread into surrounding soft tissues. Because of this, treatment whether by irradiation or surgery should include the entire bone.

(6) More than half of these patients died within the first year. The five year survival rate for those patients treated surgically is 15.4 per cent and for those treated by other methods 10.8 per cent. The critical feature in control seems to be a combination of early diagnosis and adequate therapy.—*F. J. Rigos, M.D.*

Bassett, Robert C., and O'Connor, Sylvester J. Painful states of the shoulder and arm; diagnosis and treatment. *J. Michigan M. Soc.*, Jan., 1952, *51*, 55–61.

Painful conditions of the shoulder and arm are divided into those disorders directly affecting the nerve supply and disorders of the muscoloskeletal system. These are discussed individually giving their treatment.

Compression fractures with hypertrophic changes involving the cervical and upper thoracic vertebrae causing root syndromes are treated conservatively with head-halter, traction, heat and salicilates.

Herniated cervical discs are treated conservatively as above. If the pain persists, surgical treatment is usually necessary.

Tumors of the vertebra or spinal cord may produce isolated root signs early, but are usually accompanied by other obvious findings. The usual brachial plexus syndromes are the anterior scalene syndrome and the symptoms caused by cervical rib and anomalous first rib. The treatment of these conditions is surgical.

Peripheral nerve lesions following various types of trauma may be troublesome and usually require surgery.

The basic orthopedic disorders are difficult to diagnose and the following conditions should be considered when examining the shoulder. Periarthritis of the shoulder may be a primary inflammatory process with pain and muscle spasm. This may pass to a chronic stage with adhesive scarring. The treatment is active shoulder exercises. In the chronic phase passive manipulations are of value. Calcification in the supraspinatus tendon and subacromial bursa follow degenerative changes. If the inflammatory response is severe enough pain will develop, and some loss of motion. Treatment consists of diathermy, roentgen therapy, needling, and surgical incision and excision.

Rupture of the musculotendinous cuff gives a characteristic clinical picture. The treatment is rest followed by gentle active exercise. If after seven to ten days no improvement is noticed operative intervention is indicated.

Acromioclavicular arthritis may produce a dull aching shoulder difficult to localize. The treatment is heat, rest and salicilates. If these do not help, operative removal of the outer end of the clavicle is indicated.

Lateral epicondylitis of the humerus and radial stylalgia may cause pain in the shoulder also.

The clinical findings and therapy of these various causes of pain in the shoulder are clearly presented.—*Fay H. Squire, M.D.*

SPERLING, W. PAGH. Snapping finger; roentgen treatment and experimental production. *Acta radiol.*, Jan., 1952, *37*, 74–80.

Snapping finger, which is a condition affecting the flexor appartus of the fingers, is not at all uncommon. In this condition, flexion or extension of the affected finger does not occur as a smoothly gliding movement but is accomplished with a jerk. The cause of the obstruction to the flexion or extension is a disproportion, limited in its extent, between the diameter of the flexor tendons and that of the sheaths in which these tendons glide on the volar side. Constriction of the sheath may be due to (1) swelling of sesamoid bones, (2) generalized swelling of a limited length of the peritendineum, or (3) contracted fiber bundles of the annular and cruciate ligaments in the tendon sheath.

Since 1943 the author has used roentgen therapy in 30 instances of snapping finger in 26 patients. The ages of the patients ranged from thirteen to seventy-five years. The average age was fifty-nine years. There were 19 women and 11 men.

The roentgen therapy included the affected finger and the adjacent part of the palm. The initial series consisted of two to four treatments given daily or every second or third day; in some cases, the irradiation was repeated after an interval of a fortnight. The total dose to each affected finger varied from 500 r to 2,350 r, with an average of 1,150 r. In all of the 30 cases less pain on movement, subsidence of generalized swelling and less tenderness were observed after irradiation. Twenty-one of the 30 cases were completely cured (every case became symptom-free within a four week period).

By experimenting on himself, the author concluded that a single trauma to the flexor apparatus of the fingers is not necessary for the production of a snapping finger but that numerous small movements, which individually are neither abnormal nor strenuous, may lead to the condition. Many persons engaged in industry, handicrafts, and domestic work are exposed to the risk of developing snapping fingers. It is possible that the condition develops more readily if it is preceded by a trauma to the subsequently affected region.—*Mary Frances Vastine, M.D.*

MERCHANT, FREDERICK T. Solitary myeloma of rib simulating mediastinal tumor; report of a case. *Surgery*, Feb., 1952, *31*, 285–290.

"Solitary myeloma" is a term applied in those cases in which a single myeloma has remained the only lesion for a prolonged period of time, roentgen examination of other bones gives negative results, and repeated sternal biopsies do not disclose any abnormality. A case which the author believes to fulfill most of the criteria for solitary myeloma is presented.

A woman, aged sixty-four who had always been healthy complained of dyspnea and orthopnea of three weeks' duration. A diagnosis of congestive heart disease had been made. Three thousand five hundred cubic centimeters of fluid had been aspirated from the right pleural space, whereupon a roentgenogram revealed, in the right side of the thorax, a large mass that was erroneously interpreted as being a pulmonary cyst. Bronchograms disclosed that the lesion was extrapulmonary, and the mass was then considered probably to be a mediastinal dermoid. At operation it was found that the huge mass arose from the anterior end of the right fifth rib and that it was a myeloma. Postoperative recovery was uneventful. About a year and a half later, pain in the back, ascites and anemia developed. Death occurred a month later, presumably due to myelomatous metastasis, although this could not be proved as necropsy was refused. Sternal biopsy gave negative results.—*André Bruwer, M.D.*

Lindblom, K. Arthrography. *J. Faculty of Radiologists*, Jan., 1952, *3*, 151–163.

Lindblom has used arthrography for the morphological study of a joint in fracture or destruction of cartilages; rupture and atrophy of menisci, ligaments or tendons; capsular rupture; loose bodies; hypertrophy, and tumors of the capsule. He found it essential that the contrast material mix with the synovial fluid and become absorbed without long-standing joint irritation. A water-soluble dye such as uroselectan on perabrodil (diodrast) fulfills these requirements. The amount of 35 per cent perabrodil used was: 10 cc. in the knee, 6 to 7 cc. in the shoulder and hip, and 3 to 4 cc. in the elbow and ankle, and as little as 0.5 to 1 cc. in the small joints, such as the temporomandibular joint. The addition of 1 cc. of 2 per cent novocain to the perabrodil is advisable. Extensive movements help to spread the contrast material.

Lindblom found the greatest field for arthrography in the knee joint, in studying the meniscus and ligamentous lesions. Over 5,000 such knee joint examinations have been made. The joint is punctured from the lateral side with the needle directed at the center of the articular surface of the patella, the latter being subluxed laterally during the injection. A pad is placed under the popliteal space. With one hand above and one below the patella the joint fluid is pressed out as completely as possible. The perabrodil is injected and spread by movement of the knee joint. A circular bandage is used immediately above the patella for compression. Lindblom makes stereoscopic roentgenograms in the following views: anteroposterior in internal and external oblique with knee extended; posteroanterior with half-bent knee; lateral views (after removal of the compression bandage). The menisci and the cruciate ligaments can be satisfactorily demonstrated by this examination.

Shoulder arthrography is of value in the study of ruptures of the tendon aponeurosis (supraspinatus ruptures) and lesions of the long biceps tendon. With the arm adducted and rotated outward, a thin needle is inserted just anterior to the acromial joint and directed toward the center of the humeral head. After touching the bone, the needle is withdrawn about 1 mm. during injection. The normal arthrogram shows a thin contrast line ending at the tendinous insertion of the tubercle. In lesions of the tendon aponeurosis, the contrast medium fills the rupture at the site of the tendinous insertion and demonstrates the communication with the subacromial bursa in cases of complete rupture—also, the tendinous retraction of old cases.

In the normal arthrogram of the ankle a recess extends 1 cm. upward into the tibiofibular syndesmosis. In fresh syndesmose ruptures the contrast medium spreads into the adjacent tissues.

In hip arthrography there are demonstrated the joint space between the head and acetabulum, a filling defect due to the ligamentum teres, and the lower and posterior recesses with a waist caused by the zona orbicularis. The patient is supine, with affected hip elevated. The needle is inserted from the anterior side toward the center of the head. The needle must be passed caudal to the cartilage margin of the acetabulum.

Elbow arthrography is used for demonstration of ligamentous ruptures and loose bodies. The joint is punctured from the lateral side just proximal to the radial head.

In wrist arthrography the wrist is punctured from the radionavicular fossa toward the navicular bone.

For mandibular arthrography the reader is referred to a thesis of Flemming Norgaard (1944).—*Samuel G. Henderson, M.D.*

Pöschl, M. Röntgenbild und Röntgenbestrahlung bei der Arthrosis alkaptonurica; kasuistischer Beitrag. (Roentgen diagnosis and roentgen therapy in arthrosis alkaptonurica; a case report.) *Fortschr. a. d. Geb. d. Röntgent strahlen ver. m. Röntgenpraxis*, Jan., 1952, *76*, 97–101.

Alkaptonuria (ochronosis) is a disturbance of the protein metabolism, in which the homogentisic acid, instead of being further split into the end products of the protein metabolism, is excreted as such in the urine. It is also partly deposited in the cartilage, tendons, fasciae and the intima of the blood vessels. In the tissues it takes on a brown or dark color, which can clinically be seen in the larynx, nose, ears, etc. Urine, earwax and sweat may have a brownish appearance. Symptoms do not usually occur until middle age, when an arthrosis develops due to the deposits in the joint cartilage.

Roentgenologically the most marked changes are seen in the spine. The large joints are also involved.

The roentgen examination of the reported case showed marked narrowing of the intervetebral spaces with large bony bridges and bony spurs. The sacroiliac joints were sclerosed. The shoulder, hip and knee joints showed destructive changes with secondary arthrotic reaction. Round areas of decreased density were seen in the pelvis, condyles of the femora and heads of the humeri, evidently representing ochronotic deposits.

The treatment of this disease consists in limitation of the protein intake and the administration of ascorbic acid, since animal experiments have shown that this latter is necessary for the catabolism of some of the amino acids. The joint symptoms are treated as in any other arthrosis. In the reported case roentgen therapy to the knees and spine (6 treatments, beginning with 80 r increasing to 200 r at the last treatment with several days' interval) achieved considerable subjective improvement.—*Hans W. Hefke, M.D.*

KELLGREN, J. H., and MOORE, R. Generalized osteoarthritis and Heberden's nodes. *Brit. M. J.*, Jan. 26, 1952, *1*, 181–187.

From a study of 391 cases of osteoarthritis attending their Rheumatic Clinic, the authors have selected a group of cases representing a definite clinical entity for which they suggest the name primary generalized osteoarthritis. This condition occurs most frequently in middle-aged women, and is characterized by a distinct pattern of joint involvement, by a course in which each affected joint passes through an initial painful and more or less acute arthritic phase.

This disease is considered to be a constitutional disorder affecting the di-arthrodial joints and probably represents a severe form of idiopathic Heberden's nodes.

A trial of estrogen therapy in this series proved to be of no value.—*William A. Klauber, Jr., M.D.*

PALTRINIERI, G. La scoliose mégalothymique. (Megalothymic scoliosis.) *J. de radiol. et d'électrol. & Arch. d'électric. méd.*, 1952, *33*, 30–34.

The author coins the name of "megalothymic scoliosis" for a syndrome characterized by an association of thymic enlargement with scoliosis of the dorsolumbar spine.

The patients affected are usually infants and the medical consultation is requested by the parents because of a deformity of the spine in the lower dorsal and upper lumbar regions. Symptoms or signs pointing to the possibility of enlargement of the thymic gland may be completely lacking. It appears that until now no attempts have been made to link the two conditions to each other.

The first case was observed by the author about three years ago. The infant son of a pediatrician was noted by his father to develop progressive scoliosis in the dorsolumbar region without evidence of other symptoms. Fearful of a crippling deformity the father asked for a roentgenographic study of the entire spine. During this examination a marked enlargement of the thymus was accidentally found. Administration of roentgen therapy over the thymic region resulted in disappearance of the thymic enlargement followed later by complete regression of the scoliosis.

Since then, similar observations have been made in 10 additional infants. Most of them were males and the convexity of the scoliosis was usually to the left. The thymic enlargement was of the pedunculated type, enveloping the heart like a cloak and casting an asymmetrical shadow on the roentgenogram. Sometimes definite clinical symptoms were present suggestive of enlargeemnt of the thymus.

It is the author's opinion that the scoliosis does not represent an endocrine disturbance due to hyperthymism but is the result of a convenient posture assumed by the child to relieve the pressure effect of the enlarged thymus on the surrounding structures. The deformity occurs only when the pressure extends to one side and especially when it affects the hilus, heart and great vessels, in particular the pulmonary artery. Following adequate roentgen therapy of the thymic enlargement, the scoliosis corrects itself within four to eight months. However, in the chronic cases, in which the functional equilibrium of the muscles governing the statics of the spine has already been seriously impaired prior to the institution of the treatment, it may persist totally or partially despite the elimination of the original cause.—*T. Leucutia, M.D.*

EYRE-BROOK, A. L. A study of late results from disk operations; present employment and residual complaints. *Brit. J. Surg.*, Jan., 1952, *39*, 289–296.

This is an excellent article on the follow-up of over 100 consecutive cases operated on for sciatic pain. The author carefully reviews the pathology involved and concludes that there is an idiopathic degeneration of the disc prior to actual herniation. He explains the periodic remissions and exacerabtions by one of three possibilities:

(1) Stretching of the nerve roots.
(2) Extrusion of the herniated contents by rupture of the fibrous layer.
(3) An alteration in the relation of the nerve root to the prolapse.

In his series, he emphasizes the high incidence of lesions at L-5, and to a lesser degree, at the L-4 level. He also states that routine roentgen studies confirm the operative findings in only 41 per cent of the cases while failing in 47 per cent and even misleading in 12 per cent of the cases.

The surgery consisted of no more than removal of the degenerated disc material. In no case was a spinal fusion performed. Residual complaints in patients with proved disc herniations were few. Eighty-six out of 99 had no significant complaints, while 8 out of 11 negative explorations had residual difficulties. Subsequent history has not as yet revealed the cause for sciatica in any of these cases. Of the 21 patients who performed heavy manual labor, 18 returned to their former occupations.—*Frank R. Hendrickson, M.D.*

BRODIN, HARALD. Myelography with water soluble contrast medium in lumbar and sacro-lumbar tuberculous spondylitis. *Acta orthop. Scandinav.*, 1951, *21*, 259–272.

It has sometimes been found at operation that pathologic findings in myelograms of patients with lumbago-sciatic-like pain have been interpreted as herniation of an intervertebral disc instead of as tuberculous spondylitis. As it is thus apparently difficult to distinguish these conditions, a study was made

of myelograms of patients with obvious tuberculous spondylitis in the hope that it might reveal details differing from those in the picture of a herniated intervertebral disc.

Thirteen male and 17 female patients with certain tuberculous spondylitis somewhere between the second lumbar and the first sacral vertebra were studied. Of the 30 patients the tuberculous spondylitis was considered "healed" in 4 and unhealed in 26. In 25 of the unhealed cases the myelogram showed a varying sized anteroposterior indentation towards the dura regularly in or near the midline. The depths was greatest caudal to the center of the indentation. In 3 of the "healed" cases the distance between the bodies and the dura was smaller at the level of the "healed" spondylitis than cranial or caudal to it.

No correlation was found between the size of the indentation and that of the skeletal foci.

The nervous symptoms, practically always slight, were observed in 43 per cent of the 30 cases. These symptoms seem to be due more to the indentation than to the presence of any vertebral compression.

Compression of the nerve roots by tuberculous spondylitis need not cause radiating pain, even though peripheral signs of root involvement are demonstrated (numbness plus relatively impaired sensibility).—*Robert K. Arbuckle, M.D.*

Calihan, Robert, J. Anterior sacral meningocele. *Radiology*, Jan., 1952, *58*, 104–108.

Anterior sacral meningocele is a relatively rare entity. Only about 52 cases have been reported. It is a congenital anomaly characterized by agenesis of a part of the anterior portion of the sacrum, herniation of meninges through the defect, and formation of a hernial sac in the pelvis. The presence of the anterior defect differentiates this anomaly from the more common posterior sacral meningocele. Symptoms are usually secondary to the pressure of the meningocele on the rectum, urinary bladder, and other pelvic organs.

Roentgenographic findings are characteristic. The agenesis of the anterior portion of the sacrum may be unilateral or bilateral and usually involves the lower half of the bone. Definite proof of the lesion may be obtained by myelography.

The author reports 3 cases of anterior meningocele. Anteroposterior roentgenograms revealed agenesis of the sacrum in each of these cases. The diagnosis was confirmed by myelography in 2 of these patients. The radiopaque material injected into the subarachnoid space was demonstrated in the herniated meningeal sac anterior to the sacrum.

None of the cases were treated surgically.—*A. W. Sommer, M.D.*

Ottley, C. M. Lobstein's syndrome. *Arch. Dis. Childhood*, Feb., 1952, *27*, 105–106.

The purpose of this brief paper is to describe a family in which many members showed the hereditary condition (osteopsathyrosis) named by Lobstein in 1933.

The cardinal manifestations of Lobstein's syndrome are fragility of bones, blue coloration of the sclerae, and deafness (otosclerosis), occurring singly or in combination in affected members of certain families. Subsidiary features include malformation of the skull (crâne à rebord), precocious arcus senilis, laxity of ligaments, abnormal electrical reactions of the muscles, white patches in the nails, unusual fineness of the hair, and deficient formation of dental enamel.

In the family under consideration the most striking feature was the tendency for the females to be more severely affected than the males. No male member is known to have exhibited the whole triad of cardinal signs. Since the date of the author's first paper in 1932, two members (mother and daughter) have had operations for cystic mastitis, the mother on both breasts, the daughter on one, at the age of only twenty-one. The daughter, now aged twenty-three, presents a particularly well marked arcus senilis, most striking in so young a woman, and sclerae of a slaty blue. She has never had a fracture. She has as yet no sign of otosclerosis. The mother had an operation for hallux valgus in 1937; the excised bone showed no histological abnormality. She is now stone deaf, able to hear nothing without a hearing apparatus and little with it.—*Stephen N. Tager, M.D.*

Schulte, Karl. Zur Marmorknochenerkrankung nach Albers-Schönberg. (Marble bones, or Albers-Schönberg's disease.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Dec., 1951, *75*, 720–724.

Generalized osteosclerosis, abnormal fragility of the bones, and a secondary anemia are the basic findings, which may be associated with disturbance of hearing, paralysis of other cranial nerves, osteomyelitic processes, particularly in the maxilla, calcification of other organs, changes in the teeth, and an elevated blood calcium.

Harnapp divided the cases into 3 groups: (1) malignant osteosclerosis, with brittle bones and anemia, seen most frequently in childhood; (2) generally benign osteosclerosis, with fractures but no anemia; (3) osteosclerosis without fractures or anemia.

The disease is hereditary and recessive.

The spongiosa is replaced by massive masses of bone, and the marrow cavities are obliterated. Osteoblastic carcinomatosis; lead, phosphorus, fluoride and strontium poisoning; melorheostosis; Paget's disease, and leutic osteitis must be differentiated. It is believed that osteosclerosis secondary to blood dyscrasias is not associated with brittleness of the bones.

A case is presented in which a fracture of the

femoral shaft at the age of twenty-eight healed, but one of the neck of the same femur at the age of thirty-one did not. The only abnormalities, in addition to the bone changes, were an elevated blood calcium and a slight lymphocytosis.—*John J. B Light, M.D.*

HERNDON, CHARLES H., and HEYMAN, CLARENCE H. Legg-Perthes disease; an evaluation of treatment by traction and ischial weight-bearing brace. *J. Bone & Joint Surg.*, Jan., 1952, *34-A*, 25–46.

The authors' purpose in presenting this study is to report upon a series of 41 hips with Legg-Perthes disease uniformly treated by traction and a non-weight-bearing brace. The cases were studied clinically and roentgenographically after an average follow-up period of 7.4 years. All were treated uniformly by traction until there was a turning point toward regeneration, and after that with a non-weight-bearing traction brace until regeneration was well advanced. In determining the roentgenographic end-result rating in the cases, an objective method of estimation and recording was used, in which various components of the deformity were reduced to a measurable basis. Conventional rating of the clinical and functional result was based on both the patient's and the surgeon's estimates. Thirty-six of the affected hips were considered by the patients to be as good as normal. Four thought the result was good, but reported some restriction of motion or occasional pain; and 1 patient had symptoms so severe that he had to change his occupation. Conventional ratings as determined by the examiner were normal, 12; good, 21; fair, 4; poor, 4.

The authors state that they do not necessarily advocate the method of treatment employed in the series, but they attempted to show as accurately as possible what may be expected when their method is used.

The paper is illustrated by serial roentgen studies of the progress of some of their cases.—*Ralph S. Bromer, M.D.*

CAVE, EDWIN F. Femoral-shaft fractures treated by medullary nailing. *New England J. Med.*, Feb. 21, 1952, *246*, 284–288.

In the hands of the skilled bone and joint surgeon who is familiar with the technique of medullary nailing, this method may be the one of choice. It is not indicated in recent fractures of young children, otherwise age is not a limiting factor. Its use in all fresh femoral fractures of adults is not necessarily indicated, but in delayed fractures or non-union and in many pathologic fractures, it is by far the best available means of treatment. It should not be employed primarily in compound fractures. It is better to allow healing of the soft tissues and later, within a few days, insert the nail. It is of great aid in the management of a patient with associated severe abdominal or chest wounds or with extensive burns when external fixation is not possible, provided the patient can withstand the major operation required for insertion of the nail.

Ideally, the nail should extend from 1 inch above the greater trochanter to the level of the adductor tubercle distally. When soft tissue wound reaction has subsided, the patient is allowed to be ambulatory with crutches, bearing 50 per cent of his weight on the treated leg. Generally speaking, the nail should be left in place for at least one year. The fracture heals by extramedullary and periosteal callus.

Complications have been surprisingly few. Sepsis occurred in 1 case that had been previously plated and grafted. Two cases developed phlebitis of the thigh and both recovered. In 700 cases reported by 15 surgeons from all parts of the United States, the commonest complications were surgical shock, pulmonary emboli and infection. Fat emboli did not occur in a single case. The author has used this method in 14 cases of pathologic fractures, all of whom were bedridden at the time of insertion and would have remained so.—*Chauncey N. Borman, M.D.*

VOM SAAL, FREDERICK. Intramedullary fixation of the tibia. *J. Bone & Joint Surg.*, Jan., 1952, *34-A*, 86–95.

Thirty-four tibiae were fixed by means of nested U-nails of which 26 were followed from one to four years by the author. In all cases, there was rapid union of the tibia. In his procedure, displacement or resection of a piece of the fibula is an essential part of the technique, in spite of the fact that non-union of the fibula may occur. He uses external fixation only if the fracture is in the proximal third of the tibia. All patients bore weight on the affected limb within one week of reduction except 2 who had compound comminuted fractures.

If the fibular fragments are not displaced, premature union of the fibula may cause distraction and non-union of the tibia. In the series, a small amount of overlap of the fibula was found at follow-up examination in every case. If the fibula is intact or if the fragments cannot be displaced, it should be osteotomized and a piece should be removed. This bone, together with that removed from the tubercle, may be packed about the fracture site. Contraindications to medullary nailing are loss of skin, local or generalized infection, active tuberculosis or severe circulatory disturbance. In pathological fractures, pinning is contraindicated if the area of involvement is within 3½ inches of the knee or within 2 inches of the ankle joint.—*Ralph S. Bromer, M.D.*

MAGILLIGAN, DONALD J., and DULLIGAN, PETER J., JR. Milkman's pseudofracture; a

form of osteomalacia. *J. Bone & Joint Surg.*, Jan., 1952, *34-A*, 170–174.

The authors state that the case reported in this paper illustrates the fact that the pseudofractures seen in the roentgenograms and diagnosed as Milkman's syndrome are not the result of some unknown etiological factor but rather represent advanced stages of osteomalacia. Roentgenograms of their patient showed bilateral symmetrical pseudofractures in the femoral necks. Examination of the skull, chest and long bones revealed a decrease in bone density but no additional pseudofractures.

Reference is made to Milkman's original reports in which he stated that his case represented a distinct new clinical entity and that it was not one of osteomalacia. He suggested that the zones of radiolucency, the pseudofractures seen on roentgen examination were due to some trophic disturbance, and that there was a peculiar pattern of bone absorption which was atypical for any known disease entity.

The several reasons given by Albright and Reifenstein for the classification of Milkman's syndrome as a form of osteomalacia are:

1. The symmetrical pseudofractures or zones of decalcification are also seen in rickets and were described by many German physicians, following World War I, in persons with marked dietary deficiencies.

2. Lesions resembling pseudofractures occur in conditions other than osteomalacia but they always develop through areas of bone obviously pathological while in osteomalacia the pseudofractures appear in bone that has an otherwise normal roentgenographic appearance.

3. Review of the cases of Milkman's syndrome reveals the serum-calcium and phosphorus levels to be consistent with osteomalacia.

4. There are excellent responses to therapy with vitamin D and other fat-soluble vitamins.

Osteomalacia due to steatorrhea is discussed in the paper. Absorption occurs mainly in the upper part of the small intestine. The commonest cause of hypovitaminosis D in adults in the United States is steatorrhea. The two chief causes of steatorrhea in this country are: (1) an idiopathic steatorrhea which is called non-tropical sprue or in children, celiac disease, (2) chronic pancreatitis. A third cause of steatorrhea is insufficiency of the small intestine, resulting from any one of a number of causes but often from short-circuiting operations.

The authors note that Milkman's case report describes an associated pancreatic disease, diabetes. The case reported in this paper had a chronic pancreatitis with pancreatic calculi. They conclude that their case is sufficiently similar to Milkman's to suggest that they have the same basic etiology.—*Ralph S. Bromer, M.D.*

Blood and Lymph System

Maurer, Elmer R. The surgical significance of calcified parabronchial and paratracheal lymph glands. *J. Thoracic Surg.*, Jan., 1952, *23*, 97–110.

The serious significance of the presence of calcified lymph nodes in and about the tracheobronchial tree probably has not received sufficient emphasis in the past. In patients with isolated areas of atelectasis due to bronchial compression by calcified lymph nodes, the clinical history, physical findings, roentgenographic changes, and even endoscopic and bronchographic studies can be identical with the findings encountered in patients with atelectasis which is due to a peripherally located or extrabronchial pulmonary carcinoma.

More careful preoperative roentgenologic studies of the chest using Potter-Bucky technique, laminagrams, and if necessary bronchography, are invaluable in demonstrating the presence of calcified lymph nodes and their relationship to portions of the tracheobronchial tree which might be obstructed by compression.

The finding of calcified lymph nodes by roentgenograms in and about the tracheobronchial tree is usually associated with dense scarring of the mediastinal and interlobar structures, and difficult surgical dissection at the time of operation can be anticipated. The mere presence of nonobstructing calcified lymph nodes about the lobar bronchi may necessitate the performance of more radical procedures than were preoperatively anticipated to remove lesions for which more conservative surgery is ordinarily recommended.

As with other nonmalignant lesions producing bronchial obstruction, complete excision of the destroyed portions of lung with the calcified lymph nodes will invariably result in a cure.—*T. C. Stansbury, Jr., M.D.*

Veal, J. Ross, and Cotsonas, Nicholas J., Jr. Diseases of the superior vena caval system with special consideration of pathology and diagnosis. *Surgery*, Jan., 1952, *31*, 1–12.

Diseases of the superior vena caval system are uncommon. The authors deal with 137 cases encountered at the Gallinger Hospital (more than 1,400 beds) during a fifteen year period.

Phlebography with the use of a 70 per cent solution of diodrast may be employed to determine the site of obstruction and the size, number and distribution of the collateral channels. This method may also be of value in determining the causes of obstruction of the innominate veins and superior vena cava, regions in which ordinary roentgenograms may be erroneously interpreted. For instance, an aneurysm of the arch and ascending aorta will obstruct the superior vena cava by displacement, whereas a malignant growth will obstruct the vein by invasion without displacement.

Venous hypertension in the upper extremities and normal venous pressure in the femoral veins estab-

lish the diagnosis of "obstruction of the superior vena cava and/or both innominate veins." Venous hypertension in one upper extremity, with normal venous pressures in the other and in the femoral veins indicates obstruction of axillary and subclavian veins or the innominate vein on that side alone or of all. Occlusion of axillary or subclavian veins is distinguished from occlusion of innominate veins by distention of or hypertension in internal jugular veins in the latter condition.

An "exercise test" for the upper limb is mentioned, which is valuable in determining the presence of obstruction in the superior vena caval system.

In 50 cases the superior vena caval segment was involved; in 58 thrombosis of the axillary or subclavian veins was present, and in 14 cases (heroin addicts) there was septic thrombophlebitis of the brachial veins; 11 patients had obstruction of the innominate vein and 4 had septic thrombophlebitis of the jugular veins.

In the acute stage of obstruction of the superior vena cava, all the venous radicles of this system are engorged. Edema follows and cyanosed regions may be striking. Venous pressures of the arm are high and femoral pressures are normal. All other symptoms are directly owing to the primary cause, that is, carcinoma. The acute phase lasts one to three weeks, and then symptoms and signs become those of incomplete occlusion. If obstruction of the superior vena cava is proximal to the azygos vein, the latter takes over the function of the obstructed vessel. The deep veins will then form main collaterals, and the superficial network will not be much in evidence. If the obstruction of the superior vena cava is below the level of the azygos vein, the superficial collaterals become prominent over the thorax and abdomen, and blood returns to the heart via the inferior vena cava. In 50 cases of obstruction of the superior vena cava neoplasms were the cause in 22, and aortic aneurysms in 16. In 12 cases the cause could not be determined. In these cases the cause was usually classified as thrombosis owing to mediastinitis.

In the 58 cases of obstruction of the axillary or subclavian veins, stasis thrombosis owing to congestive heart failure was present in 25. In 17 of these 25 cases pulmonary infarction developed. Effort type acute thrombosis was present in 21 cases, acute thrombophlebitis in 2 and thrombosis secondary to neoplasm in 10. Both segments usually were involved simultaneously. Pain, swelling and cyanosis of the involved extremity were seen in acute cases. When the acute phase subsides, the typical superficial venous pattern may be the only clue to diagnosis.

In 10 of the 11 cases of obstruction of the innominate veins the vein on the left was affected. In all cases the cause was compression by aneurysm. Congestion of the superficial veins of the involved extremity and distention of the veins of the neck on the affected side were typical findings.

There were 14 cases of septic thrombophlebitis of the veins in the arms. All of these patients were heroin addicts who had given their own injections. Twelve of these suffered pulmonary infarction.—*André Bruwer, M.B., Ch. B.*

DETERLING, RALPH A., JR. Direct and retrograde aortography. *Surgery*, Jan., 1952, *31*, 88–114.

Visualization of blood vessels in the living person by means of opaque media was first reported in 1923 (Sicard and Forestier; Berberich and Hirsh). The materials used were iodized oil and strontium bromide, both of which proved unsatisfactory and dangerous. Brooks (1924) introduced aqueous sodium iodide, which is considered safe for peripheral arteriography in concentrations of 30 per cent or less, and for translumbar aortography in solutions up to 100 per cent (dos Santos). Sodium iodide is colorless but may become pale yellow after autoclaving and yet remain safe. It becomes deep yellow on deteriorating. The salt contains 85 per cent iodine. The two most widely used contrast media in America are the organic iodide compounds, diodrast and neo-iopax. The salt used in diodrast contains 62 per cent iodine. It is supplied in 35 per cent and 70 per cent concentrations. The salt used in neo-iopax contains 51 per cent iodine, and is supplied in 35 per cent and 75 per cent concentrations. Sodium iodide is more radiopaque than any of the other substances mentioned.

For a few seconds during and after the rapid injection of any of the opaque media, the blood pressure rises. This is followed by hypotension and bradycardia which may last from a few seconds to more than a minute. A period of hypertension, tachycardia and increased pulse pressure follows, lasting up to five minutes in dogs and much longer in human beings. The opaque media are listed in the order in which they produced increased severity of these symptoms: thorotrast, diodrast, neo-iopax and sodium iodide.

Radioactivity of thorotrast may be shown by means of a Geiger counter many years after injection of the substance, and histopathologic changes may also be discovered long after its injection.

Large doses of sodium iodide may produce iodism. In order to carry out aortography, however, a dose of 0.4 gm. of iodide per kilogram of body weight has been administered to human beings in three divided doses, without serious consequences.

Diodrast is less likely to cause iodism than sodium iodide. Flushing of the face, urticaria, apprehension, dizziness and nausea usually constitute the severest symptoms. Intimal damage has been reported with the use of all iodides.

Neo-iopax produces symptoms similar to those caused by diodrast, with addition of dryness of mouth.

Aortography can be classified as abdominal and thoracic by direct or retrograde routes.

Translumbar aortography, a type of abdominal aortography by the direct route, was first reported by dos Santos in 1929. It has been used to evaluate urologic disorders, abdominal tumors, vascular lesions, placenta previa, and so forth.

Severe hepatic, renal or cardiac disease probably contraindicates the procedure, but extremes of age are no deterrent. Premedication is similar to that for major abdominal surgery. The procedure is carried out with the patient on a roentgenographic table, with a Potter-Bucky grid. A positioning film is exposed first. Factors used are as follows: 70 to 80 kv., 200 ma., 0.3 second exposure at tube distance of 30 inches (76.20 cm.), and a 14 by 17 inch film (35.56 by 43.18 cm.). Local infiltration of skin and paravertebral region is carried out with 0.5 to 1 per cent solution of procaine. Twenty cubic centimeters of 75 per cent concentration of neo-iopax is also used. Pain is experienced only if there is extravasation. The point of cutaneous perforation is 2 cm. below the twelfth rib and about 7 cm. to the left of the spinous process. A malleable 16 cm. 18 gauge needle is used. When the aorta is entered a trickle of blood rather than a pulsatile stream emits from the needle. Barbotage should be gentle, as resistance indicates poor position of the needle point. It has not been felt necessary to use a pressure device. In order to show the abdominal aorta or its primary visceral branches, the film should be exposed immediately after injection of the iodide; if the iliac or femoral arteries are to be shown, a delay of one to three seconds is advised. Immediately after injection of the iodide, 30 cc. of saline solution should be injected. Inadvertent injection of sodium iodide into intestinal arteries has resulted in death, whereas similar incidents with organic iodides have had no serious consequences. Also, extravasation of sodium iodide causes rather severe chemical neurities, whereas a similar accident with neo-iopax was without any ill effect and the material was resorbed in an hour.

Translumbar aortography was used in 55 cases for conditions such as aneurysm, occulsive disease, renal diseases and extrinsic displacement. Smith and his colleagues have done more than 700 aortographies with organic iodides without a death. Sensitivity tests for iodides were not done prior to aortography.

The authors have not used the retrograde route because they have not found an occasion in which the direct route was unsatisfactory, and because of certain practical disadvantages of the retrograde method. Retrograde aortography was first described by Castellanos in 1937.

In thoracic aortography the direct route was used first by Navoli in 1936. It necessitates a direct needle approach and the method has not been used extensively. Its safety is difficult to evaluate at this time.

The retrograde route has been used by means of needle injection of the axillary or brachial arteries or of the left common carotid. A ureteral catheter has been employed via the radial artery. The brachial, ulnar and axillary arteries have been used for catheterization. The author has changed from the ulnar approach (3 patients) to the left common carotid approach (12 patients). Most of these patients had coaractation of the aorta. In several instances the coronary arteries were used, with no untoward symptoms. One fatality occurred in the group in which the ulnar arteries were injected. Death resulted apparently from dislodgment of an atheromatous plaque and subsequent cerebral infarction. In the group in which the carotid arteries were used, transient aphasia and contralateral hemiplegia occurred twice.

For variations in technique of the various methods of aortography, the original article should be consulted.—*André Bruwer, M.B., Ch. B.*

Loose, K. E. Zur Arteriographie; Serienarteriographie, lumbale, subdiaphragmale Aortographie. (On arteriography; serial arteriography, lumbar and subdiaphragmatic aortography.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Feb., 1952, *76*, 173–180.

Arteriography is an innocuous and informative method for angiological diagnosis. It is increasingly important for the development of vascular surgery. Lately, this method has been widened in scope by serial arteriography, lumbar aortography and subdiaphragmatic aortography.

The author first describes his technique for arteriography. He uses 70 per cent ioduron of which 30 cc. are injected rapidly. After injection, roentgenograms of the thigh and leg are made simultaneously using two roentgen tubes which are 17 inches away from each other and at a distance of 21 inches from the two cassettes. Six roentgenograms of the thigh and six of the leg are made at intervals of three seconds.

Next, the lumbar aortography is discussed which is done for visualization of the lower abdominal aorta and the pelvic arteries. The aorta is punctured at the level of the second or third lumbar vertebra by using a 6 inch long needle which has a 1.2 to 1.5 mm. diameter. After arterial blood is seen spurting from the needle, the contrast medium (30 cc. 70 per cent ioduron) is rapidly injected under pressure. The exposure is made during the injection of the last 5 cc.

For visualization of the renal arteries and abdominal aorta, the subdiaphragmatic aortography is used. The needle is inserted into the aorta at the level of the twelfth thoracic vertebra. Otherwise, the procedure is identical with the one used for lumbar aortography.

Each of these three techniques is illustrated by one

case with excellent reproduction of roentgenograms.

Contraindications for examination are hypersensitivity to iodine, hyperthyroidism and liver or kidney damage. The intradermal test (1 cc.) is used for determining iodine sensitivity.—*Egon G. Wissing, M.D.*

General

DOWNING, JOHN GODWIN. Cancer of skin and occupational trauma. *J.A.M.A.*, Jan. 26, 1952, *148*, 245–252.

The author discusses the problem of skin cancer and other cancers arising from the exposure to various chemical and physical agents used in industry. He presents 14 cases illustrating various types of skin cancers arising from occupational hazards. From his study and from a review of the literature, he arrives at the following conclusion:

Claims for compensation for skin cancer due to occupational trauma are rare, but cases of occupational cutaneous cancer do exist. The cancer appears on exposed areas of the skin. A careful history should reveal whether or not occupation is a factor. The typical studies of the incidence of industrial skin diseases are likely to be misleading. The reported incidence of occupational skin cancer is low but the records do not reveal the true incidence. Cases of cancer of the skin allegedly from tar, arsenic, creosote, solvents, paraffin wax, and repeated injury are cited. The essential criteria for the establishment of proof that physical injury could cause cancer must be stressed. The criteria are: (1) previous integrity of wounded part; (2) origin of tumor at exact point of injury; (3) reasonable time limit between injury and appearance of tumor; (4) diagnosis of presence and nature of tumor by biopsy.

The problem of prevention of occupational skin cancer rests on the individual physician. A careful history should make him suspicious of the occupational exposure and stimulate proper agencies to conduct thorough investigations. Accepted methods for proper prevention of illness among employees should be sought where there is shown an occupational hazard.—*B. B. Gay, Jr., M.D.*

BRANTE, G. Gargoylism—a mucopolysaccharidosis. *Scandinav. J. Clin. & Lab. Investig.*, 1952, *4*, 43–46.

During the past two years the author has had the opportunity of studying 3 typical cases of the disease by means of histochemical and analytic methods. The disease was found to be characterized by a generalized disturbance of supporting tissue development associated with deposition in most tissues of certain substances.

Histologically and histochemically the deposits are characterized by lipids and mucopolysaccharides, particularly the latter. The author then concludes that the clinical and histological phenomena reported to be present in gargoylism all seem readily explainable by the hypothesis that this disease is a consequence of a mucopolysaccharide metabolism disturbance.—*James J. McCort, M.D.*

EVERETT, FRANK G., JUMP, ELLIS B., SUTHERLAND, WALLACE F., SAVARA, BHIM SEN, and SUHER, THEODORE. Anhidrotic ectodermal dysplasia with anodontia: a study of two families. *J. Am. Dent. A.*, Feb., 1952, *44*, 173–186.

Anhidrotic ectodermal dysplasia is a rare, hereditary abnormality of which the outstanding characteristics are anhidrosis or hypohidrosis, anodontia or oligodontia and hypotrichosis. Patients afflicted with this malformation show a typical facies resembling that of congenital syphilis; their skin is soft, thin and dry, the hair sparse and thin. Atypical cases have been described. These patients are sometimes seen as infants with minor ailments or with severe hyperthermia, caused by hot weather. This difficulty can be explained by the inability to perspire sufficiently. Treatment is largely symptomatic. During later years, dental abnormalities become apparent and prosthetic appliances are usually indicated and they must be adjusted or remade as the child matures.

The authors report 2 cases (1) a male, aged eight and a half, white, and (2) a female, aged three and a half, colored. The boy showed a negative physical examination except for sparse head hair, absent body hair, and edentulous oral cavity. During his early years he suffered from hyperthermia, pathosis of the respiratory mucosa and a deficiency of saliva as well as of hair and teeth. At the present time, he has reasonable control of his body temperature but must avoid extreme heat and direct exposure of the sun in summer. The second case presented similar findings except that there were a few rudimentary teeth present.—*Robert K. Arbuckle, M.D.*

CRECELIUS, W. Ein Beitrag zum Krankheitsbild der Osteopathia dysplastica familiaris. (A contribution to the clinical picture of osteopathia dysplastica familiaris.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Feb., 1952, *76*, 196–202.

In a brief discussion of the literature the author separates the hypertrophic osteoarthropathy of intrathoracic etiology from clubbing of the fingers and toes without known etiology. The roentgen findings are an increase in soft tissues of the finger tips, rounding of nails and destruction of the unguicular tuberosity. Later stages of the process are evidenced by atrophy of the terminal phalanx and hypertrophic changes of the periosteum. In cases of osteoarthropathy without pulmonary or mediastinal pathology, numerous etiologic factors are cited in the literature, *e.g.*, increase in soft tissue capillaries,

neurotoxic agents and frequently endocrinological disturbances. Occasional reports are concerned with the familial occurrence of the disease.

The author describes 3 cases accidentally discovered in one family. Of 11 siblings, 1 female and 2 males showed definite clubbing. Roentgenologically the typical findings were demonstrated in the bones of hands and feet. In 1 case there was marked destruction of the tuberosity. The change was first noted in infancy and had caused no symptoms. Aside from slight acromegalic features and ovarian hypofunction in the first patient there was no evidence of endocrinological disorder. None of the patients showed evidence of intrathoracic pathology. Various function studies failed to show pathological features. The long bones of forearm and leg were normal. Two other siblings were known to have unusually large hands and feet. In these, roentgenological examination was negative, however.—*Kurt Benirschke, M.D.*

Lowe, Charles Upton, Terry, Mary, and MacLachlan, E. A. Organic aciduria, decreased renal ammonia production, hydrophthalmos, and mental retardation; a clinical entity. *A.M.A. Am. J. Dis. Child.*, Feb., 1952, *83*, 164–184.

The patients whose cases are reported in this paper had abnormalities of renal function, bone disease, mental retardation, and congenital glaucoma. This is apparently a unique combination, and the authors could find no reports of similar children in the literature. Systemic acidosis, hydrophthalmos, organic aciduria and decreased ability to fabricate ammonia in the kidney were present. Without the aid of therapy, 2 of the 3 cases reported in the paper exhibited osteomalacia or rickets.

The authors make an attempt to compare their cases with other persons suffering from rickets and renal disease. They feel they cannot include their condition with any previously described syndrome. The hypothesis is presented that their condition may represent a previously unreported syndrome which has its pathogenesis in (1) an inborn error in metabolism producing excess organic acids for excretion and (2) impaired renal function. Data are presented to show that the children are dependent upon added base for the achievement of a normal skeleton and that vitamin D is at least partly able to assert its normal function.

Roentgenograms are shown which demonstrate recurrence of rickets while the patient received no vitamin D. Calcium lactate and sodium citrate were added to vitamin D and cure of the rachitic condition resulted, as proved by the roentgenograms.—*Ralph S. Bromer, M.D.*

RADIATION THERAPY

Diethelm, L., Goldhammer, H., and Brat, L. Spätergebnisse der Radiumbehandlung von Haemangiomen nach mehr als 10-jähriger Beobachtungszeit unter besonderer Berücksichtigung des kosmetischen Effektes. (Late results of radium treatment of hemangiomas with an observation period of ten years or more and with special reference to cosmetic effects.) *Strahlentherapie*, 1952, *86*, 263–270.

Radiation treatment of hemangiomas with a single dose method or with high total dose methods yielded poor cosmetic results in 42 cases which were followed for ten years or more. Therefore, fractionation and low to moderate total dosage are recommended.—*Henry G. Moehring, M.D.*

Hellriegel, Werner, and Keudel, Waltraud. Über die Behandlung der Strahlendermatitis mit azulenhaltiger Salbe. (Treatment of radiation dermatitis with azulen-containing ointment.) *Strahlentherapie*, 1952, *86*, 241–248.

Radiation dermatitis is an inflammatory process. Hence the use of camomile's familiar anti-inflammatory effect in its treatment was natural. Then a blue, oil extract, "chamazulen," was demonstrated to have the same anti-inflammatory effect. Finally, 1-isopropyl-5-methylazulen was developed synthetically and used clinically with a vaseline-lanolin base azulen ointment (Chemiewerk Homburg A.G.).

Clinical observations revealed that azulen produced more rapid healing of radiation dermatitis than a neutral ointment (containing eucerin and lime water). When azulen was used in the course of intense radiation therapy, even in an infant, the dermatitis which developed was much less pronounced than anticipated. Azulen, in conjunction with a disinfecting powder containing chemotherapeutic agents, was also helpful in healing persistent, non-radiation ulcers.—*Henry G. Moehring, M.D.*

Jenkinson, E. L., Norman, R. C., and Wilson, J. A. Radiation therapy of the non-traumatic painful shoulder. *Radiology*, Feb., 1952, *58*, 192–198.

The authors present their technique and results in the treatment of 318 cases of the painful shoulder conditions known as peritendinitis of the shoulder, subacromial bursitis, subdeltoid bursitis, or supraspinatus tendinitis.

For simplification, these conditions are all grouped under the term bursitis and are classified as follows:

Group I. Acute: symptoms limited to seven days' duration or less.

Group II. Chronic: duration of symptoms over seven days.

Group III. Acute exacerbation of chronic bursitis: an acute flare-up of symptoms in a patient who has had previous similar attacks over a period of months or years.

After a discussion of the anatomy and pathogenesis of the condition, the technique used in this series is stated and is as follows: a 50 cm. target-skin distance is used and two fields are irradiated (anterior and posterior) using a 10 by 10 cm. cone centered over the point of greatest tenderness. Factors are: 200 kv. constant potential; 10 ma.; a thoraeus filter of 0.44 mm. tin, 0.25 mm. copper, and 1.0 mm. aluminum; a half-value layer of 1.9 mm. copper; 200 r (air) is administered each day, for six treatments. Four anterior treatments and two posterior are given resulting in a total of 800 r (air) anterior and 400 r (air) posterior. The total depth dose at 3 cm. from the anterior skin is 1,028 r for the entire course.

The results were as follows:

Group I. 85 patients treated of whom 70 obtained complete relief, 8 were 50 per cent relieved, and 1 was a complete failure.

Group II. 195 patients treated of whom 44 obtained complete relief, 88 were 75 per cent relieved, 45 were 50 per cent improved, and 8 failed to respond.

Group III. 38 patients treated of whom 24 obtained complete relief of symptoms, 9 had 75 per cent relief, 3 were 50 per cent relieved, and 2 were failures.

The follow-up is very important. Often one additional treatment after two weeks will completely relieve those cases where some symptoms yet remain.

The authors conclude that irradiation is of definite value in the treatment of bursitis of the shoulder, and gives equally good, or better results when compared with other methods.—*McClure Wilson, M.D.*

BRAIBANTI, T., and PREVEDI, G. Sul "polmone irradiato" l'importanza della stratigrafia nella diagnosi differenziale. (The "irradiated lung"; the importance of stratigraphy in differential diagnosis.) *Ann. radiol. diag.*, 1952, *24*, 27–52.

The literature on irradiation fibrosis of the lungs is extensively reviewed in this article. The isodose curves of Standstrom and the phantom studies by Clarke for depth doses delivered to the lungs are included and used by the authors in their calculations.

The authors studied 100 cases meticulously with routine chest roentgenograms and supplemented with laminagrams to determine the nature of the changes associated with radiation pulmonary fibrosis. Their patients were all cases of cancer of the breast treated by radical mastectomy and postoperative irradiation. The technique used was: 160-170 kv., filter of 0.3 mm. Cu × 1 mm. Al, size of the field 100 sq. cm. with a daily dose of 250-300 r. Three portals were employed, the anterior chest wall, the supraclavicular area and the axilla posteriorly. The anterior chest wall received a dose of approximately 2,500-3,000 r, whereas the supraclavicular and axillary fields received a dose of about 1,000-1,500 r. The dose delivered to the underlying lung was computed to be less than 2,000 r over a period of twenty days. In no case were serious respiratory symptoms or complications noted.

The most common finding was a diffuse haziness of the lung receiving the greatest amount of irradiation with some increased translucency of the rest of the lung on the same side. The apex and infraclavicular areas were most often the part of the lung involved. Some cases also showed retraction of the ribs over this area of haziness and rarely the trachea was displaced towards that side. A study of this part of the lung with laminagrams convinced the authors that this haziness is not due to edema as claimed by some reports in the literature. They believe that the pleuropulmonary changes are rather characterized by a nebulous grayish density, and represent either streaked or circumscribed areas of fibrosis.

In those cases with metastases the laminagram is particularly helpful in detecting pulmonary nodules or mediastinal adenopathy and is most helpful in differentiating these from pulmonary fibrosis.—*Peter E. Russo, M.D.*

ROLAND, MAXWELL, and WEINBERG, ARTHUR. Radiation effect on the unborn embryo immediately after conception. *Am. J. Obst. & Gynec.*, Nov., 1951, *62*, 1167–1169.

Only a small proportion of mutations that are dominating may be expected to show genetic effects in the first postirradiated generation. Radiation experiments on human reproductive organs are impossible. When an "experiment" occurs accidentally, observations and conclusions based upon it are important to record.

A twenty-four year old white woman, nulliparous, was first seen on June 20, 1949, with a history of infertility of two years' duration. Her menstrual cycles were irregular and occurred from four to nine weeks apart, lasting three to four days with no dysmenorrhea.

Pelvic examination revealed the vulva to be slightly underdeveloped. Bimanual examination showed the uterus to be small, smooth, and anterior. The laboratory findings were negative. Both tubes were patent on hysterosalpingographic examination. An endometrial biopsy, on the twenty-seventh day of the cycle, revealed a persistent follicular phase. The basal body chart for several months confirmed the presence of anovulatory cycles.

The patient was placed on cyclic therapy due to hypoplasia. After three months' therapy, the uterus enlarged to normal size. Menses became regular, occurring every twenty-eight days. The cycles continued to be anovulatory. Pregnant mare serum was then given. This produced no change in the endometrium, confirmed by several endometrial biopsies. Progesterone was then given. This, too, had no

effect. It was decided to give roentgen stimulation to the pituitary. From June 8, 1949, to July 5, 1949, 600 r (in air) to the left and right temple respectively was administered for the pituitary in divided doses. For the next six months, endometrial biopsies and basal body temperature charts were employed with no change of the endometrium. She continued to have a persistent follicular phase. Small roentgen stimulating doses to the ovaries were then attempted. She was warned not to conceive during this period of therapy. On Jan. 18, 1950, 100 r (in air) to the left and right pelvic regions anteriorly was applied. On Jan. 25, 1950, another 100 r (in air) posteriorly to the right and left pelvic regions was given with 200 kv., and 10 by 12 cm. portals. When the patient returned for her third and last treatment, she stated that she was several days late. Her last menstrual period was on Dec. 25, 1949. Further irradiation was not advised due to the possibility that she might have become pregnant in the interval. She admitted she had avoided contraceptives. An Aschheim-Zondek test was positive.

As the patient was anxious to have a child, she was allowed to go to term. Endocrines were advised to prevent a spontaneous abortion. After nine months, a normal labor and an uncomplicated delivery followed. She was delivered of a normal male baby. An examination of the baby, six months later, revealed a normal growth and development.

The subjecting of the very early embryo to radiation therapy, due to the patient's conception contrary to instructions, produced a grave situation. The choice was either to perform a therapeutic abortion and so avoid a possible monstrosity, or to permit pregnancy to proceed. It had never been shown that such a "small" amount of radiation was harmful to the human embryo.

The fear of untoward effects of irradiation at conception time may not be entirely justified. Evidently, an early embryo is not as sensitive to the roentgen dosage used in the treatment of sterility as had been supposed.—*Stephen N. Tager, M.D.*

Ulfelder, Howard, and Meigs, Joe V. The surgery of advanced pelvic cancer in women. *New England J. Med.*, Feb. 14, 1952, *246*, 243–247.

The authors report their experience with 46 cases of advanced pelvic cancer. Block resection of the tumor with the pelvic lymphatics and lymph nodes was done if a cure seemed possible, but whenever this goal has been compatible with preservation of the intestine or the urinary tract, a less than total extirpation was performed.

In 8 patients there was no excision of any portion of the urinary tract. Most patients were slow to regain the faculty of micturition, and bladder sensation may be absent for months. Three patients are in good health, thirty-six, eighteen and ten months respectively.

The bowel was spared in 11 patients. This operation was used mostly in cases of cervical cancer (Stage IV) with a less than 4 per cent chance of cure by radiation and is really an extended version of the operation of total cystectomy. It is an inadequate operation as all patients are dead or have recurrent disease.

Removal of all pelvic viscera with diversion of fecal and urinary drainage was done 27 times. In 8 other women the operation was limited to exploration or biopsy. There were 6 deaths. The ureteroenterostomy is the most annoying source of complication and an attempt must be made to solve this situation. Of this group, 25 were operated upon more than nine months ago. Recurrence of cancer has appeared in 7 of the 19 who lived, but in 6 of them it was known that cure had not been accomplished at the time of operation. All patients had a slow recovery of appetite, strength and a desire to go home.

Although the authors have decreased the morbidity and mortality, there is no justification for a change in the indications for surgery. The operation should be limited to patients whose chance of cure by any other form of therapy is less than 5 per cent. —*Norman Heilbrun, M.D.*

Cosbie, W. G. The treatment of cancer of the vulva. *Am. J. Obst. & Gynec.*, Feb., 1952, *63*, 251–259.

The author discusses 185 cases of carcinoma of the vulva seen since 1929. Fifteen cases are not included in the statistical analysis.

The close cooperation between the radiological and surgical services is mentioned. The poor results with irradiation alone led the late Dr. G. Richards to adopt the surgical approach as the management of choice. Postirradiation vulvitis, edema, the resistance of secondary deposits and the low over-all survival rate are among the reasons quoted for this change in treatment.

Since 1935, based primarily on the contributions of Taussig, radical vulvectomy has been performed. Originally, the Basset technique was used. The modified procedure consists of a radical vulvectomy with block dissection of the lymph node bearing portion of the fatty part of Scarpa's triangle, extending well beyond Poupart's ligament to include the fatty tissue of the mons veneris. Since 1948 this operation has been extended to include the extraperitoneal deep pelvic lymphadenectomy.

The age and physical condition of the patient, the site of the lesion, its extent and the state of the lymph nodes are important factors in evaluating the prognosis.

Twenty patients were seen between 1929 and 1934. Of these, 19 received treatment with 4 surviving (20 per cent). No details are given in this group.

One hundred patients were observed between 1935

and 1946, 9 of whom were unsuitable for treatment. Of the 91 remaining, 46 had advanced lesions and 45 moderately advanced. Forty-nine of this group of 91 patients were subjected to radical surgery as outlined above. Seventy-four per cent of the moderately advanced cases and 50 per cent of the advanced cases survived five years. There were 14 patients with positive lymph nodes, 29 per cent of whom survived five years.

There were 2 patients treated with interstitial radium and pelvic lymphadenectomy both of whom are living and well at five years.

Fifty patients were seen since 1946. In this group, radical vulvectomy and lymphadenectomy have been performed for 24 moderate and 11 advanced lesions. Seventy per cent of all patients and 83 percent of those treated by radical vulvectomy and lymphadenectomy are alive at the present time.

The author recommends that this major surgical operation be done in stages rather than at one sitting, especially when the patients are elderly.

Eleven of 18 patients who failed to survive five years after the radical procedure were investigated. Five developed recurrences in the area of the initial tumor. Five more developed recurrence at this site after the fifth year. —*Frederick W. O'Brien, Jr., M.D.*

MURPHY, WALTER T., and BERENS, DAVID L. Late sequelae following cancericidal irradiation in children; a report of three cases. *Radiology*, Jan., 1952, *58*, 35–42.

Three children, aged four months, one year, and nine years respectively received roentgen therapy for malignant tumor. Several years later, these individuals were studied as to bone and soft tissue changes produced by this irradiation.

Case I, a four month old child with a diagnosis of probable Ewing's tumor of the proximal half of the right femur was followed for twelve years after treatment. Eighteen months previous to the last examination, an epiphyseal arrest operation was done on the distal left femur, at which time it was 5 inches longer than the right. At the last examination there was minimal hypoplasia of the right femoral head, neck and proximal shaft. The distal femoral epiphysis was closed and there was marked atrophy of the right thigh muscles.

Case II, a one year old female, with a diagnosis of Wilms' tumor (later changed to neuroblastoma) of the left kidney was followed for fifteen years after treatment. At last examination, roentgenograms showed poor development of the vertebral rings, especially on the left, with a decrease in height of the left lateral borders of the vertebrae. There was a 1 inch shortening of the left lower extremity.

Case III, a nine year old boy, with a diagnosis of squamous cell carcinoma of the left hard palate and left alveolar ridge, was followed for nine years. At last examination, there was clinical and roentgen evidence of retardation of growth of the left maxilla as compared to the right.

These 3 cases of cancer in children treated intensively with radiation showed permanent structural and growth changes of the bones and soft tissues several years after treatment. These changes cannot be avoided if a clinical cure is desired.—*McClure Wilson, M.D.*

HARVEY, ROGER A., HAAS, LEWIS L., and LAUGHLIN, JOHN S. Betatron cancer therapy. *Radiology*, Jan., 1952, *58*, 23–34.

Twenty-four million electron volt roentgen rays produced by means of a betatron were given clinical trial. Physical factors for the unit have been given in a previous communication. The biological efficiency of these roentgen rays is approximately 1:2 for maximum tolerance effects when compared with the generally used 200 kv. beam. The dose is measured by means of a thick-walled (3.5 cm. lucite) thimble chamber. A tumor dose of 7,500 to 10,000 r delivered in $3\frac{1}{2}$ to $4\frac{1}{2}$ weeks is recommended using at least five portals. Because of the high exit dose, the entrance and exit portals should not be superimposed.

Treatment was carried out on 33 patients with advanced malignant disease. The variety in types of disease and the variability in dosage precluded analysis, hence the pertinent details concerning the treatment of each patient are presented in tabular form. The patients tolerated tumor doses up to 10,000 r with portal areas up to 200 cm^2. The average dose for irradiated normal tissue averaged 12 per cent of the dose at the center of the tumor, while the integral volume dose for normal tissue exceeded twice the integral volume dose for the tumor in only 1 case out of 8 so analyzed. One patient, treated with a tumor dose of 2,874 betatron r to the skull, showed epilation of the exit portals only, while another patient, treated with 5,746 r to the skull, showed practically complete, but not permanent, epilation.—*M. B. Goodwin, M.D.*

VON MOOSE, F. Hautsarkom nach Röntgenbestrahlung. (Sarcoma of the skin following roentgen irradiation.) *Schweiz. med. Wchnschr.*, Feb. 16, 1952, *82*, 179–181.

A carcinoma developing in a previously irradiated skin has been observed and reported many times. The development of a sarcoma, however, has not been noted so commonly except in those cases in which the patient was irradiated for a pre-existing skin disease such as tuberculosis, eczema, keloids, burns, etc.

Malignant tumors in a previously irradiated area usually develop slowly and produce metastasis in relatively rare instances. The lesion spreads only locally, ulcerates fast, but does not show a great tendency to expansive growth.

The interval between a preceding radiation therapy and the development of a late tumor varies greatly, with an average of approximately nine to twenty years, but has been observed up to forty-five years.

The author reports a case of a sixty-five year old patient who received an epilation dose of roentgen radiation thirty years ago for growth of hair in her face. The exact amount of radiation could not be determined. The radiation therapy was followed by a moderate reaction with swelling of the face, redness of the skin, which persisted for a long time, particularly on the cheeks and around the jaw, and by two small ulcerations which were present in the area where the tumor developed later. However, these superficial lesions healed and patient was completely free of symptoms for fifteen years. At that time the skin again showed redness and an increasing amount of brownish pigmentation. A small ulceration was biopsied and proved to be benign. These lesions healed completely within a few weeks. Thirty years after the original treatment, the patient noticed a small hard nodule on the chin which extended rapidly underneath the jaw within a few weeks. The histopathological examination showed a spindle cell sarcoma. At this time the patient also showed extensive radiation changes of the skin with atrophy, telangiectasis and ulceration. The tumor extended rapidly and a complete excision was impossible. The patient died very shortly after a few weeks' illness.

At autopsy, the tumor proved to be a spindle cell sarcoma of the right lower jaw extending into the right side of the neck, into the upper pole of the thyroid with break through into the pharynx. The right side of the floor of the mouth was completely infiltrated and pulmonary metastases were present.

One must distinguish two possibilities of sarcoma developing following radiation therapy. One possibility is that the sarcoma appears in an irradiated skin which prior to treatment was entirely normal. The second possibility is that the sarcoma develops in a skin which was previously altered by a pre-existing pathology such as eczema, tuberculosis, lupus, psoriasis, etc. The second possibility seems to be more common, probably because of more intensive irradiation and pre-existing damage to the skin.—*H. Peter Mueller, M.D.*

Gilbert, René. Le problème de la gravidité dans la maladie de Hodgkin (en relation avec les progrès de la radiothérapie). (The problem of pregnancy in Hodgkin's disease [in relation to the progress of radiation therapy].) *J. de radiol. et d'électrol. & Arch. d'électric. méd.*, 1952, *33*, 1–11.

The author gives an excellent discussion of the problem of pregnancy in Hodgkin's disease. His own material consists of 157 cases of Hodgkin's disease treated by roentgen therapy from 1922 to 1951. In 11 of these, 1 or several pregnancies occurred, 13 of which went to full term, 3 terminated prematurely and 2 were at the beginning when the patients died.

He also presents an exhaustive review of the world literature referring at length to the observations made by other investigators of the problem. In all, he was able to collect the pertinent data of 98 mothers with Hodgkin's disease including his own 13 cases. The total number of pregnancies in these women was 118, of which 90 reached full term, 7 terminated prematurely and 12 were interrupted, while 7 patients miscarried and 2 died from the disease at the beginning of their pregnancy.

The 11 personal cases are described in short résumés and the data bearing any significance on the relationship to Hodgkin's disease are meticulously tabulated.

As a result of this extensive study the author arrived at the following conclusion:

(1) The pregnancy is supported remarkably well during the period of complete remission of Hodgkin's disease following adequate roentgen therapy. A complete remission is considered to be present when the patient has remained free of clinically demonstrable signs or symptoms of the disease for at least six months. If pregnancy occurs in less than six months of the remission period, the prognosis may still be regarded as favorable when there is uniregional involvement, especially of the cervical, axillary and mediastinal areas, whereas if the Hodkgin's disease involves parts of both the upper and lower halves of the body, as, for example, the cervical region and the abdomen or the mediastinum and the inguinal region, the prognosis is unfavorable. It is therefore advised not to interrupt the pregnancy during the stage of complete remission of the Hodgkin's disease, notably when the process is localized to a single lymph node area of the upper half of the trunk.

(2) If the pregnancy occurs during the active stage of Hodgkin's disease or Hodgkin's disease is discovered during the course of pregnancy, individualization is necessary. As a rule, roentgen therapy should be tried, except in the first six months of pregnancy, since often a sufficient remission is obtained to enable full term delivery. Interruption of the pregnancy per se does not help bring about a more favorable clinical course of Hodgkin's disease.

(3) It may be desirable to advise the mother against nursing the baby, although no untoward effects were noted in the cases in which it was practiced.

(4) The risk of transmission of the disease to the offspring is minimal. The 3 cases reported in the literature are of questionable documentary value. All children of the author's patients and the great majority of those described in the literature are healthy and are developing normally for their phenotype. The photographs of 12 children from 8 mothers of the personal series are included.

The author believes that marriage and motherhood should be discouraged in cases of Hodgkin's disease although admittedly such advice is often disregarded by the patient.—*T. Leucutia, M.D.*

OESER, H. Behandlungsresultate bei Larynx- und Hypopharynxkarzinomen. (Results of treatment of laryngeal and hypopharyngeal carcinomas. *Strahlentherapie*, 1952, *86*, 401–410.

An absolute increase in the number of laryngeal and hypopharyngeal carcinomas has occurred recently. The incidence of these tumors gradually rises with age.

Half of the patients with laryngeal carcinoma are curable and every fifth patient with hypopharyngeal carcinoma can be rendered symptom-free for at least three years by radiation therapy.

The clinical stage and extent and the biologic quality of the tumor are critical factors in determining the outcome of treatment.—*Henry G. Moehring, M.D.*

FELTON, LELAND R. Beam-directed high-dosage radiotherapy of bronchogenic carcinoma. *Radiology*, Jan., 1952, *58*, 43–47.

A review of the literature would seem to indicate that roentgen therapy given to patients with inoperable bronchogenic carcinoma does not materially prolong life-expectancy.

Twelve cases of proved inoperable bronchogenic carcinoma were treated by the author with accurate beam-directed roentgen therapy in high doses using the multiple portal technique modified after that of Dobbie and Denny. This method permits accurate localization of the tumor, accurate direction of the beam, and at the same time minimal skin dose with a cancerocidal tumor dose. The minimal tumor dose delivered was 5,700 to 7,300 r.

These 12 patients had an average survival time of 21.6 months following the onset of symptoms, and /or 16.0 months following diagnosis. On the basis of these results, the author suggests that high dosage beam-directed roentgen therapy will prolong the survival time in patients with inoperable bronchogenic carcinoma.—*McClure Wilson, M.D.*

KALKOFF, K. W. Über die Sonderstellung des Lupuskarzinoms unter Berücksichtigung der Konsequenzen für Therapie und Prophylaxe. (The singular position of lupus-carcinoma in regard to therapy and prophylaxis.) *Strahlentherapie*, 1952, *86*, 468–476.

The development of carcinoma in lupus vulgaris (lupus-carcinoma) is second only to tuberculosis as a cause of death in patients with lupus. Several factors account for the poor prognosis in patients with lupus-carcinoma:

The carcinoma develops in a tissue bed that is already damaged, so that the radiation dosage margin between tumor destruction and tissue destruction is narrowed. Radiation therapy of the carcinoma is thus rendered difficult and even impossible.

Removal of a focus of lupus-carcinoma does not produce cure because new carcinomas continue to crop up.

In order not to damage the tissue bed further in lupus, removal of lupus-carcinomas should be done with an electric cutting loop as long as conditions permit an operative removal.

Prophylaxis against the development of lupus-carcinoma begins with the prevention of lupus, the prevention of tuberculous cervical lymphadenitis, and thus the prevention of tuberculosis in dairy cattle. Once lupus has appeared, chronic irritants of whatever form (including radiation therapy) should be avoided. Animal or vegetable fats may help combat the atrophy of the skin.

Most important in the prophylaxis is an active antilupus organization to alert patients with lupus to the dangers inherent in the disease, to bring prophylactic measures to their attention, and to bring them under treatment early in the course of their disease.—*Henry G. Moehring, M.D.*

FLEISCHER, H., GEBAUER, A., and WACHSMANN, F. Verwendung transversaler Schichtaufnahmen bei der Festlegung des Bestrahlungsplanes intrathorakaler Tumoren. (Use of transverse laminagraphy for the determination of the plan of roentgen therapy of intrathoracic tumors.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Jan., 1952, *76*, 52–60.

The choice of the most effective plan of treatment of thoracic tumors is greatly facilitated by transverse laminagraphy. The size and location of the correct portals for crossfiring and especially rotation therapy are easily determined. The method also gives information about the depth, extent and relationship to the surrounding structures of the tumor.

Six cases are discussed and illustrations presented. —*Frederick M. Reis, M.D.*

BAUD J., and COURTIAL, J. La roentgenthérapie à 500 kV modifie-t-elle les résultats du traitement des cancers du col utréin? (Does roentgen therapy at 500 kv. modify the results of the treatment of the cancer of the uterine cervix?) *Bull. Assoc. franç. l'étude cancer*, 1952, *39*, 134–140.

At the Curie Foundation of Paris, using 500 kv. and 6 ma. and a filtration of 6 mm. of steel, the authors could obtain 15 to 16 r per minute (measured in air) on the skin of a patient 1 meter distant from the radiant focus. At a 10 cm. depth the tissues receive 48 per cent of the dose registered on the surface of the skin for a portal of entry of 150 sq. cm. and

50 per cent for a portal of entry of 250 sq. cm. This increase in the depth dose seems to be the main advantage.

On the basis of 190 cases of epithelioma of the uterine cervix treated with roentgen therapy with the above given factors, associated with intracavitary and vaginal radium therapy, the authors conclude that there is no difference in the five year survival rate of the different stages of this neoplasm as compared to treatment with 200 kv., for example, associated with radium therapy. However, because of increased depth dose the over-all period of treatment of the pelvis can be shortened to six weeks when 500 kv. is employed. When four portals of entry were used, osseous radionecrotic complications were more frequent; whereas, using two portals of entry (anteroposterior and posteroanterior) rectovaginal complications were prevalent, necessitating special measures to protect the rectum during treatment.—*Jirair N. Sarian, M.D.*

Cosbie, W. G. The fate of the patient with advanced cancer of the cervix of the uterus. *Am. J. Obst. & Gynec.*, Jan., 1952, *63*, 108–115.

In the ten years, 1938 to 1947, 858 patients with cancer of the cervix of the uterus sought treatment at the Toronto General Hospital. Five hundred thirty-five of them, or 62 per cent, had advanced lesions which were classified as Stage III or Stage IV and this paper is based on a study of these women.

In the eighteen years from 1929 to 1947, the authors observed very little change in the distribution of cases according to the extent of the lesion. The onset of symptoms which indicates the presence of cancer of the cervix is variable and the duration of the symptoms gives little indication as to the involvement that has taken place.

Bleeding, discharge, and pain are the cardinal symptoms of cancer of the cervix. This group of patients did not conform to the classical pattern. Over one-third did not have bleeding as the first symptom. Vaginal discharge which was described in many different ways was the first symptom of one-fifth of them and over 10 per cent had an onset with less indicative complaints such as dull backache, pelvic pain, dysuria, or simply malaise and loss of weight. It is apparent that this lack of localizing symptoms failed to impress some physicians with the need for a pelvic examination as over 20 per cent of the patients were delayed from three to six months before they were referred for treatment.

Forty-seven patients were nuliparous. This is an incidence of 9 per cent. However, only 8 of these women had never been pregnant so that the nongravid incidence is only 1.5 per cent. This suggests the etiological importance of pregnancy rather than childbirth.

This study has been made since 1937 because since then the treatment of cancer of the cervix has followed almost a uniform plan. High voltage roentgen therapy has been given at 400 kv. through six portals, followed by radium therapy in three to six weeks' time. Intracavitary platinum-screened radium has been applied against the vaginal aspect of the tumor to a dose of 4,200 mg. hr. in both positions. Roentgen therapy has also been given by means of a vaginal cone when there was massive involvement of the vault of the vagina and the supra- and perivaginal tissues.

Patients who were overweight could not receive a satisfactory depth dose from high voltage roentgen therapy and some therefore received only radium therapy supplemented occasionally by roentgen therapy by means of the vaginal cone. In others, the extent of the tumor distorted the cervix and made the intracavitary application of radium impossible. As a result of these modifications less than half of the patients received a full course of therapy.

One hundred and ten patients had recurrence of cancer after a period of healing. There is always great difficulty in differentiating between residual post-irradiation thickening in the pelvis and malignant infiltration. When pain and edema and pelvic thickening are all present, recurrence of the tumor is almost certainly the cause. Life expectancy is increased two to three times by treatment when the recurrence is confined to the pelvis but the same good results are lacking when recurrence is widespread.

When survival is short the local lesion persists and deep involvement increases. As survival lengthens local control of the tumor is more frequent and, although the deep pelvic lesion remains, the dominant feature, distant metastases, which are recognized more readily in bony tissue or the lung, gradually take a greater place in the persisting disease.

This small series is in exact agreement with the figures recently published by Morris and Meigs, showing a much higher incidence of distant metastases than could be recognized clinically. Seventeen of the 27 patients had extrapelvic metastases, the lymph nodes, liver, and lungs being the most frequent sites.—*Eugene J. McDonald, M.D.*

RADIOISOTOPES

Mayneord, W. V. Radiography of the human body with radioactive isotopes. *Lancet*, Feb. 9, 1952, *1*, 276–278.

Various aspects of the application of radioisotopes to diagnostic radiology are considered. Isotopes emitting radiation within the diagnostic range (65-100 kv.) are known. Many are unsuited because of short lives, large numbers of beta particles, emission of high energy gamma rays, or else the isotope may not be available in large quantities.

Thulium 170, a rare earth of the lanthanide series, with a half-life of 127 days, decays by beta-gamma emission (exact scheme unknown) to ground state ytterbium 170. The bulk of the radiation from the thulium-ytterbium mixture is monochromatic gam-

ma rays of about 84 kv. and characteristic ytterbium roentgen rays of about 50 kv. energy. The mean absorption corresponds to about 75 kv. radiation.

For the radiographic source, chips of radiothulium oxide were sealed in a small glass tube by a fitted ebonite rod. This point source was surrounded by a 5 mm. radius plastic sphere, to reduce the intense beta radiation. This source could conveniently be placed within a body cavity. Placed in the buccal cavity, and in the nasopharynx in a dried skull, radiographs of the mandible and maxilla resulted with fair definition and contrast. With the author's weak experimental source, exposure times of one to twelve hours were necessary.

Other applications are suggested, and the advantages of such sources are given, such as great portability and unrestricted use without a power supply. —*Zygmunt S. Gierlach, M.D.*

CHOU, SHELLEY N., MOORE, GEORGE E., and MARVIN, JAMES F. Localization of brain tumors with radioiodide^{131}. *Science*, Feb. 1, 1952, *115*, 119–120.

The localization obtained with an isotope encephalometer indicates an area in the brain in which the blood-brain barrier has been disrupted, thus allowing extravascular diffusion of anions. The high "uptake" of I^{131} is due to this disruption plus abnormal protein binding in the tumor tissue. NaI supplies more available I^{131} than either radioactive diiodofluorescin or radioactive iodinated human serum albumin; it can be administered orally, and is more economical.

The procedure used herein calls for a tracer dose of 300 microcuries NaI given orally to "lugolized" patients (lugolization requires 10 drops of Lugol's solution three times daily for three to four days starting twenty-four hours prior to the administration of the tracer). One hour after oral administration of NaI, the head is surveyed with the scintillation counter. The counting rate over different positions of the head will reach 4,000 to 7,000 per minute.

In this report, 9 tumors were correctly diagnosed, 2 tumors ruled out, 1 chronic inflammatory focus localized, and 1 false positive diagnosis made.—*John D. Reeves, M.D.*

TYOR, MALCOLM P., and CAYER, DAVID. Studies with iodine-tagged albumin in cirrhotic patients. *South. M. J.*, Feb., 1952, *45*, 141–145.

This study is concerned with the mobility and rate of utilization of protein molecules. A small but detectable amount of human serum albumin labeled with radioiodine (I^{131}) was administered intravenously (11 control patients, 7 with cirrhosis, and 5 with cirrhosis and ascites), allowed to mix with the body pool, and serve as both an indicator of metabolism of native albumin and as a measure of labile stores.

Intravascular mixing was adequate by fifteen minutes. Mean plasma volume was similar in the three groups. Lowest value for total circulating albumin was in those patients with cirrhosis and ascites. Rate of albumin disappearance from the vascular compartment was significantly delayed after the initial forty-eight hours in the group with cirrhosis and ascites; probably due to a decreased rate of albumin metabolism. Both groups of cirrhotics had a reduction in serum albumin concentration.

The authors feel that "The defect in albumin metabolism is of primary importance in the pathogenesis of ascites." Other factors are considered and their roles discussed.—*Zygmunt S. Gierlach, M.D.*

HOMMA, J. YUZURU; KATSURA, TADAO; HOSOYA, SEIGO; MIYAZAKI, YOSHIO; KIMURA, KENJIRO, and SAITO, NOBUFUSA. P^{32}-labeled endotoxin of pseudomonas aeruginosa; preliminary report—isolation of radioactive endotoxin from culture filtrate on synthetic media containing P^{32}-labeled phosphate and its distribution in mice. *Japan. J. Exper. Med.*, Dec., 1951, *21*, 381–393.

Since it has become possible to extract and isolate endotoxin many studies have been made on the relation of the chemical structure of endotoxin to its antigenicity and toxicity. However, little has been done on investigating the fate of the toxin itself after being injected into the living body.

It has been found that the endotoxin of *Pseudomonas aeruginosa* could be isolated and purified from culture filtrate. This endotoxin is composed mainly of nucleoprotein and accordingly there seemed to be the possibility of labeling the toxin with P^{32} by adding P^{32}-labeled phosphate into the fluid synthetic culture medium. This was done successfully; P^{32}-labeled endotoxin was isolated, and its distribution after being given to mice recorded. The radioactive isotope P^{32} was taken into the endotoxin molecule as the firmly combined organic phosphorus and had similar immunological and biological properties with those of the non-labeled endotoxin.

Tracer studies revealed that strong radioactivity was present in the liver, intestinal wall and bones, within a short time of P^{32} being injected into mice. The P^{32}-labeled endotoxin was apparently fixed in those tissues without any remarkable chemical changes. In mice, left for one month after immunization with bacilli, radioactivity was found in the lungs as well as in the liver.

Pronounced inflammatory changes were seen morphologically in the liver where considerable radioactivity was present. This finding was identical in both the labeled and non-labeled endotoxin. In the immunized animals in which P^{32}-labeled endotoxin was assumed to be fixed in the lungs marked interalveolar pneumonia was found.—*Frank J. Rigos, M.D.*

Perlmutter, Martin, Weisenfeld, Shirley, Slater, Stanley, and Wallace, Eleanor Z. A study of the mechanism of the inhibition of the thyroid gland induced by ingestion of thyroid substance. *J. Clin. Endocrinol. & Metabol.*, Feb., 1952, *12*, 208–227.

The authors give the following summary of their investigations:

1. The effect of the intramuscular administration of varying doses of the thyroid-stimulating hormone (TSH) of the pituitary gland upon the function of the thyroid gland has been studied in 18 normal subjects. Ten milligrams of TSH was the dose which was minimally effective in increasing the uptake of I^{131} by the thyroid gland and the level of the serum protein bound iodine (PBI), these having been determined to be the most sensitive indices of thyroid function.

2. The ingestion of 120 mg. of thyroid substance daily for twelve or more days resulted in a decrease in the thyroidal uptake of I^{131} to hypothyroid levels, unaccompanied by any increase in the level of the serum PBI and with only a slight increase in the BMR.

3. Both the serum PBI level and the mean uptake of I^{131} by the thyroid gland, which had been inhibited by ingestion of thyroid substance, could be increased to hyperthyroid levels by the administration of 10 mg. or 60 mg. of TSH.

4. After similar doses of TSH, the increment in the uptake of I^{131} by the thyroid gland, which had been inhibited by ingestion of thyroid substance, was greater than the increment in the uptake in the control studies. The total collection of I^{131} in the former case, however, was less than the total uptake in the latter. Both the increase in, and the highest levels reached by, the serum PBI in response to TSH injections were the same in the control and in the thyroid-inhibited periods.

5. Rebound hypofunction of the thyroid gland was noted fourteen days following an injection of 60 mg. of TSH. Rebound hypothyroidism was not noted following the administration of 10 mg. of TSH.

6. A second dose of TSH administered during this rebound phase evoked not only a greater increment in, but also a greater total collection of I^{131} than had been noted following the original dose of TSH. The increase in the level of serum PBI was the same after each of the two injections of TSH.

7. These data lend support to the view that ingestion of thyroid substance decreases the function of the thyroid gland primarily through pituitary inhibition. To a minor degree, the ingested thyroid substance appears to decrease the responsiveness of the thyroid gland to administered TSH.—*John D. Reeves, M.D.*

Maloof, Farahe, and Chapman, Earle M. Responses to radioactive iodine therapy in hyperthyroidism, with special reference to cardiac problems. *J. Clin. Endocrinol.*, Nov., 1951, *11*, 1296–1322.

The authors have reviewed 330 thyrotoxic patients treated with radioiodine. The series includes 47 cardiacs of whom 10 had recurrent toxicity following thyroidectomy. In no instance was a patient made worse by isotope therapy. Thirty-eight of the 47 patients became euthyroid or hypothyroid. No patient was given more than three doses. The largest single dose was 15 millicuries. The largest total dose was 40.4 millicuries. Twenty-seven of the cardiac patients had auricular fibrillation. Twelve of these 27 cases reverted to a normal rhythm following radioiodine therapy. All cases responded without the use of quinidine. In 1 case, the auricular fibrillation had been converted to a regular rhythm only temporarily by quinidine before treatment with radioiodine. The authors feel that the protein bound iodine (P.B.I.) is an important guide; that is, the restoration of regular rhythm will occur only when the P.B.I. becomes normal. They also note that recurrent congestive failure is definitely lessened.

Eight of the thyrotoxic patients had associated angina pectoris. In all cases, the angina disappeared completely or was greatly ameliorated. In 1 case angina decubitus developed while the patient was taking propylthiouracil at a time during which she was supposedly euthyroid. Following treatment with radioiodine she became practically free of symptoms.

Five of the 47 patients had toxic nodular goiters. It is the policy of the authors to treat only patients who refuse surgery, or those in whom surgery is contraindicated. They describe in detail 1 case which was treated with 8 millicuries of radioiodine. One year later, because of a persistent nodule, the patient underwent surgery. A papillary adenocarcinoma was found. In view of this experience, they no longer treat toxic nodular goiter with radioiodine.

Following radioactive iodine therapy most patients show a steady decline in P.B.I. In 2 patients who did show a rise in P.B.I. there was no exacerbation of the symptoms. One patient developed a ventricular rate of 180 on the twelfth day following isotope therapy. There was no change in the serum P.B.I. The author noticed no essential difference in the response in patients who were rendered euthyroid by pretreatment with an antithyroid drug and those who had received no medication before radioiodine therapy.—*K. R. Kaess, M.D.*

Top, Franklin H. Pediatric problems arising from atomic or biological warfare. *J. Michigan M. Soc.*, Feb., 1952, *51*, 203–208.

In this article, the author reviews the effects of atomic bombing at Nagasaki and Hiroshima and the control experiments in the Pacific and speculates upon the effects of biological warfare. The reaction

of children exposed to bombing is also presented.

Most of the damage of the atomic bomb on humans is from the blast effect which causes more than half of the deaths and injuries due to the victims being tossed about or struck by falling or flying objects. The heat ray effect causes flash burns and nearly one-third of the casualties in Japanese atom bombings were due to flash burns. Atomic ray effect is least destructive and accounted for about 15 per cent of the total deaths and injuries in Nagasaki and Hiroshima. There is no difference in the human damage effect of any bomb on adults and children but it has been noted that ordinary bombing as experienced in World War II induces war strain which affects children particularly. The author has reviewed the extensive literature that has appeared during and subsequent to World War II dealing with the problems and reactions on children exposed to bombing. War strain may develop because children are in an area where bombing is frequent or because they are in a danger area and away from their parents and home and its protective authority. There appears to be no unanimity of opinion regarding the value of evacuation of children as against their remaining in bombed areas with their parents. The survey made by Dunston of 8,000 children exposed to bombing in Bristol, where air raids occurred frequently, showed that about 300 developed some signs of strain following a series of severe air raids. Of these, 120 demonstrated psychological symptoms of aggressive behavior, nervousness, trembling or crying and over 170 suffered psychosomatic disorders such as headaches, epistaxis, pallor, enuresis, indigestion, anorexia and soiling. These lasted for varying periods and were longest in the age groups between one and five and a half years, where the effects persisted for longer than seven months. The anticipated increase in the infectious and common communicable diseases did not develop, with the exception of impetigo and pediculosis and these from the nuisance standpoint were a disconcerting factor.

Regarding bacteriological warfare, it is not possible to draw factual conclusions because of the restricted information and the lack of actual reported field experiences. Bacteriological warfare is directed at producing large casualty lists in cities creating hysteria and undermining public morale; incapacitating key industries and individuals and crippling food supplies. According to the manual, "Health Services and Special Weapons Defense," issued by the Executive Office of the President, there are two forms in which a biological attack might be made: by releasing clouds of pathologic aerosols over large cities and by contaminating water and food supplies or the air of strategic buildings by sabotage. It is the author's opinion that should biological warfare become feasible the following pediatric problems would be encountered: those arising from known infections and intoxications which should be amenable to control; psychological or psychosomatic strain induced by fear of biological warfare which would affect older rather than younger children; and malnutrition resulting from lack of adequate food supplies.—*William W. Maver, M.D.*

FITZGERALD, PATRICK J. Radioautography in cancer. *Cancer*, Jan., 1952, *5*, 166–194.

Radioautography is a method of localizing radioactive isotopes at the histological or cytological level that makes possible a correlation between the presence or absence of an isotope and the histological or pathological features of the tissue. Histological sections, smears, organisms or objects containing radioactive isotopes are placed adjacent to photographic emulsion. A record is made of the reduced metallic silver of the emulsion corresponding to the radioactive areas of the object. This is possible because the rays or particles given off by the radioactive isotope reduce photographic emulsions in a manner similar to light. After processing the emulsion, the corresponding areas of the specimen and the radioautograph may be compared. The radioautograph may be viewed directly or under the magnification of the visible light microscope.

During the past few years advancements in techniques of radioautography have made it possible to identify concentrations of as little as 100 atoms of P^{32}. $Carbon^{14}$ has been demonstrated in individual blood cells.

Considerable study has been done on the concentration of radioactive isotopes in the skeleton. Ca^{45} has been found to concentrate rapidly in trabecular bone, particularly along the epiphyseal line. P^{32} concentrates more readily in the epiphyses than in the diaphyses. Likewise, it accumulates in greater amounts in young teeth than in older ones. Strontium is found in a higher concentration in the roots of teeth than in other bone. P^{32} penetrates to the growing and maturing enamel, but not to the fully developed and mature enamel. Radium is stored in the alveolar bone and teeth of rabbits.

$Strontium^{89}$ has been found to accumulate at the periphery of an osteogenic sarcoma. Radioactive gallium (Ga^{72}) concentrates in growing bone tissues —the epiphyseal area, the callus of fractures, and in transplanted mouse sarcoma.

P^{32} has been observed in higher concentrations at the epiphyses of rachitic chickens than normal fowl. Sr^{89} localized in the callus of fractures in normal rats but not in those with severe rickets.

Osteogenic sarcoma has been produced in animals following the administration of Sr^{89}, Y^{91}, Ge^{144} or Pu^{239}. The tumors were thought to be caused by the preferential localization of the isotope in collagenous tissues as demonstrated by autography.

Radioautographic studies were made of the organs of several of the radium dial painters of some years ago. Evidence of radioactivity was found in the bones and other organs many years after ingestion of the radium compound. Five of the 18 radium dial

watch painters developed osteogenic sarcomas. Autography revealed a focal, irregular concentration of radioactivity in the cortex of bone. In one case the autograph of an osteogenic sarcoma that appeared after exposure to radium gave a faint image of radioactivity.

In experiments performed, the radium was found to be distributed throughout all bones uniformly at first, but later it became concentrated focally. These concentrations may be important in the pathogenesis of radium osteogenic sarcomas.

Thorium X was found in the kidneys, spleen, liver, heart, genitals, skeleton, bone marrow and the reticulo-endothelial system.

Uranium^{233} concentrated with preference where active calcification was occurring. Endosteal, periosteal and trabecular concentrations were noted following injection of U^{232}, U^{233}, and U^{238}.

Polonium was localized in the reticular cells of the lymphatic system, splenic red pulp, bone marrow, pancreas and salivary glands. It was also found in the adrenals, the ovarian follicles, interstitial cells of the testes, the placenta, the convoluted tubules of the kidney, the Kupffer cells of the liver and the alveolar cells of the lungs.

Radium D (radiolead) was localized in the liver, spleen, kidney, intestine, muscle, heart, lung, brain, skin and pancreas. In bones, the isotope was present in zones of ossification and the periosteum.

Colloidal bismuth made radioactive with radium E injected into mice with spontaneous tumors and rabbits with tumors collected in the kidney, spleen and liver more than in the tumors.

It was shown that the treatments suggested for the purpose of removing elements such as radium from bone-low calcium diet, parathormone, ammonium chloride and citrate—did not remove plutonium from the bone but instead changed its distribution. The increasing use of the heavy radioactive elements, their affinity for bone, the potential danger to adjacent marrow, and the possibility of radiation produced sarcomas present serious problems in health physics programs.

Extensive radioautographic studies have been made of the thyroid gland. I^{131} goes rapidly to the thyroid and is incorporated into colloid of the follicles. Certain carcinomas of the thyroid concentrate I^{131} depending upon their histology. Benign thyroid tumors such as colloid goiter store I^{131} in greater amounts in the small follicles adjacent to larger follicles then in the latter. Cytologically hyperplastic areas of the thyroid can be either hyperfunctioning or hypofunctioning in regard to the concentration of iodine.

The localization of I^{131} in experimental mouse tumors produced by prolonged feeding of thiouracil revealed that the large peripheral follicles often took up the isotope whereas the central hyperplastic ones did not. This may give some support to the idea that the peripheral follicles of the mouse thyroid may be physiologically distinct from other follicles.

Other thyroid studies revealed that rats treated with thiouracil gave negative radioautographs with I^{131} in contrast to control rats whose radioautographs showed thyroid localization. Treatment with thiouracil results in a decrease in the percentage of administered I^{131} present in the thyroid follicles.

Sulfur^{35}, I^{131}, Na^{24}, and P^{32} also concentrate in the tissues of the eye. The cornea and the structures of the anterior chamber appear to be the chief sites of localization.

In the genitourinary system it has been suggested that radioautography might be used to study the formation of urinary calculi, the effects of various types of treatment on their growth and the possible effects of residual radioactivity in calculi. The kidneys, ureters, bladder and urethra have considerable resistance to radiation damage, hence can excrete these isotopes without excessive deleterious effects.

Radioautography has also been used quantitatively. It is of value in determining local concentrations or maximum radiation dosage of isotopes, particularly when there is reason to believe that a functioning unit of an organ shows concentrations many times greater than that in other areas of the organ.

Finally, radioautography has been used experimentally in embryology, tissue cultures, insect studies, protozoal, bacterial and botanical studies. Problems in protein and phosphorus metabolism have been investigated. Immunity studies and studies utilizing a two-dimensional chromatogram have been made. Radioautography has also been of great value in many miscellaneous problems related to basic research. Those interested should refer directly to this excellent and very comprehensive review.—*F. J. Rigos, M.D.*

Fields, Theodore, and LeRoy, George V. An accurate method for the measurement of radioiodine in the thyroid gland by an external counter. *Radiology*, Jan., 1952, *58*, 57–67.

A method, approaching 100 per cent accuracy, for direct external measurement of the amount of radioiodine in the thyroid gland is presented. With this method, overlapping between euthyroid and hyperthyroid uptakes is eliminated. This accuracy is accomplished by the elimination of some of the errors inherent in counting technique. The error due to the variability of the depth of the center of radiation from the thyroid gland is eliminated by determining this depth for each patient. Counts are taken at three different distances (26, 32.5 and 46.8 cm. from the surface) and the depth is calculated by means of the inverse square law. Once the depth of the center of radiation has been determined, corrections for this added distance and for the absorption of I^{131} gamma rays by the overlying soft tissues may be calcu-

lated. These corrections are applied to the counts per microcurie per minute determined from the standard at the above mentioned distances. The error due to backscatter from the surrounding soft tissue is eliminated by the use of a lead filter over the Geiger-Müller tube portal containing 1.5 grams of lead per square centimeter. Twenty-four hours following the administration of the tracer dose, body background may be ignored for all but hypothyroids. For these cases, the background count is taken from the thigh, rather than from free air, using the middle distance and subtracting this value from all three counts over the thyroid.

A brief and simple method of tabular calculation is outlined, requiring only slightly more computation than the standard single count method. Only one counting tube is required, eliminating the necessity of physical standardization of the counting tubes when more than one is used. The total counting time for each patient is six minutes, two minutes being required at each distance.—*M. B. Goodwin, M.D.*

ALLEN, HERBERT C., JR., and GOODWIN, WILLIAM E. The scintillation counter as an instrument for in vivo determination of thyroid weight. *Radiology*, Jan., 1952, *58*, 68–79.

A "wide-angle" scintillation counter using a calcium tungstate crystal as the scintillation phosphor, a 5810 photomultiplier tube, and multivibrator circuit is described. It is approximately 38 per cent efficient for I^{131} gamma rays, making it about 150 times more sensitive than the standard Geiger-Müller tube. This high sensitivity makes possible tracer studies using only 1 microcurie of radioiodine. A "directional" scintillation counter is also described which uses a calcium tungstate phosphor and a 1P21 phototube, the side window of this tube allowing for a small, convenient, columnated portal. The portal size is varied by means of a rotating head containing apertures of graduated size. The $\frac{1}{4}$ inch aperture will allow a sufficient number of photons to reach the phosphor from the thyroid for accurate counting when a tracer dose of 75–100 microcuries of I^{131} is given intravenously. This small, columnated portal allows the determination of spot intensities over the thyroid. By scanning in a coronal plane anterior to the thyroid, an anterior projection of the thyroid may be obtained. Counting rates for each square $\frac{1}{4}$ inch of area etched on a lucite grid placed anterior and parallel to the neck are recorded. The counting rate due to radiation from the soft tisuses of the neck is then determined from these values and subtracted from all of the recorded values. The resultant counting rates will be so distributed as to give an outline of the anterior projection of the thyroid gland. From this outline, the area may be determined, and, since a diffuse toxic thyroid tends to uniform expansion, its weight may be approximately estimated with the aid of a conversion factor. This method gave an average error of 10 per cent when compared with the weight of the operated specimen for 10 thyroid glands varying in weight from 10 to 132 grams. In order to further reduce this error, work using lateral neck projections is in progress. Using the above method of estimating thyroid gland weight, a single dose of I^{131} calculated to deliver 7,000 equivalent roentgens to the thyroid has been used without any increase in the incidence of post-therapeutic hypothyroidism. The therapeutic doses have ranged between 2.5 and 16 millicuries.—*M. B. Goodwin, M.D.*

CRILE, GEORGE, JR. Treatment of carcinoma of the thyroid with special reference to use of radioactive iodine. *Cleveland Clin. Quart.*, Jan., 1952, *19*, 1–5.

Radioactive iodine is most effective in the treatment of well differentiated thyroid cancers. However, since the majority of differentiated cancers are amenable to surgical cure, radioactive iodine is rarely required in these cases. It is of no value in the highly malignant cancers in which it is most needed. The usefulness of I^{131} is limited to the small group of cases in which a carcinoma of low grade has extended beyond the scope of surgical removal. Two such tumors have been encountered in a series of 105 histopathologically proved cancers of the thyroid seen at the Cleveland Clinic in the past five years and, in both cases, pulmonary and cervical metastases have disappeared in response to I^{131} therapy.—*H. J. Klos, M.D.*

FREEDBERG, A. STONE, KURLAND, GEORGE S., CHAMOVITZ, DAVID L., and URELES, ALVIN L. A critical analysis of the quantitative I^{131} therapy of thyrotoxicosis. *J. Clin. Endocrinol. & Metabol.*, Jan., 1952, *12*, 86–111.

From a survey of 10 published papers (over 1,000 patients) it is concluded that a wide variation in methods of measurement and expression of I^{131} dosage exists, making it difficult to determine precise therapeutic dosage. This study was undertaken to learn if following a tracer uptake and turnover determination a therapeutic dose would behave similarly, and to clarify relationship between therapeutic effect and estimated delivered I^{131} radiation.

Forty-two patients with unequivocal thyrotoxicosis were studied. All had a tracer dose of 100–150 microcuries of I^{131}. Thyroid uptake, urinary excretion, and biologic half-life (BHL) were determined. The BHL is the number of days necessary for the highest thyroid count to decrease by 50 per cent. This information was used to calculate the therapeutic dose from the formula:

$$\text{REP} = \text{dose (microcuries)} \times \text{uptake } \% \times \frac{\text{BHL}}{8}\ \text{(days)} \times \frac{160}{\text{thyroid wt. (grams)}}.$$

I^{131} doses were calculated to deliver a predetermined number of REP.

Average uptake of the tracer dose was about 73 per cent in twenty-four hours. Average therapeutic uptake was 71 per cent. The average BHL was 5.5 days for both tracer and therapeutic doses. The REP delivered therapeutically differed from that anticipated from the tracer studies by an average of about 14 per cent. Various factors for this deviation are discussed. The above information is condensed in a comprehensive table, listing all the patients studied.

Interesting illustrative case histories are presented. It is concluded that the uptake of a therapeutic dose can be determined if it closely follows a tracer study. Majority of patients were euthyroid after an estimated radiation of 5,800 to 17,000 (average 9,700) rep.—*Zygmunt S. Gierlach, M.D.*

Clarke, T. Howard. Radioactive colloidal gold Au^{198} in the treatment of neoplastic effusions. *Quart. Bull., Northwestern Univ. M. School*, 1952, *26*, 98–104.

Radioactive gold (Au^{198}) promises to be a better method for the palliative treatment of neoplastic effusions than either paracentesis or roentgen therapy. When Au^{198} is injected into a serous cavity it is quickly deposited on the serosal surface where most of it remains fixed for a long time. This material is easily produced and the end product is stable mercury Hg^{198}. Its half-life is 2.8 days, which is somewhat too short. The radiation delivered is approximately 95 per cent beta and 5 per cent gamma rays. The sphere of effective radiation of Au^{198} is sharply limited since the half-path of the beta particles of Au^{198} is approximately 0.4 mm. Because of its gamma radiation certain dangers exist for both patient and technician. The author illustrates a simple safe device for transferring the isotope to the patient.

The dosage in use at the present time is 125 to 150 millicuries per treatment. Occasionally patients have been given several hundred millicuries in divided doses. Radiation sickness with nausea, vomiting and cramping diarrhea occurs. Pancytopenia is a transient and apparently rarely bothersome complication. The author reports 19 patients with cancer metastases in serous cavities treated with Au^{198}. Good palliative results were obtained in 6 patients, but since the dosage of Au^{198} has been many times increased from that used in the original patients, this is not a true measure of the effectiveness of treatment. The patients classified as having received a good palliative result had carcinomas primary in the lung, breast, ovary, or colon.

It is doubtful whether a cure will often be obtained with Au^{198}, but it has been proved to be a useful adjunct in the short term palliative treatment of malignant effusions in the abdominal and pleural spaces.—*Frank J. Rigos, M.D.*

Stevens, Kingsley M. Content of, and incorporation of P^{32} into, the nucleic acids of the liver, spleen, and lymphosarcomatous tissue of man. *Cancer*, Jan., 1952, *5*, 122–125.

Although the nucleic acid content of certain animal tissues has been studied extensively, only four reports are available for human tissues. Because of this, the author reports the first combined study of the uptake of P^{32} and the nucleic acid content of human liver, spleen and lymphosarcoma. The report is based on the studies obtained on a patient with proved lymphosarcoma who received 1.7 mc. of P^{32} thirty hours before she died. This patient had previously received several forms of therapy that are known to influence nucleic acid metabolism: roentgen rays, nitrogen mustard, P^{32}, and possibly cortisone.

The desoxyribonucleic acid and the ribonucleic acid contents of the liver, spleen and a piece of lymphosarcoma were analyzed. The ratios of these substances both for amounts and activities were in fairly close agreement with those reported for similiar tissues in lower mammals. Lymphosarcoma was found to be six to seven times more active than liver; *i.e.*, the ratio of the total counts for nucleic acids to the total counts for inorganic phosphate per unit volume gives an index of relative uptake into the nucleic acids of the organ studied.—*F. J. Rigos, M.D.*

Goldeck, Hans, Groth, Henning, and Horst, Wolfgang. Strahlentherapie mit Radiophosphor bei Polycythaemia rubra vera. (Radiation therapy with radiophosphorus in polycythemia rubra vera.) *Klin. Wchnschr.*, Jan. 1, 1952, *30*, 28–30.

In treatment of polycythemia by venesections the tendency to relapse is relatively great, the intervals short. Use of phenylhydrazine and other cytostatics was soon abandoned because of their toxic sequelae. Radiophosphorus (P^{32}) has been given in the United States since 1938 resulting in a lesser tendency to recurrence than the previously known methods. Horst demonstrated (*Strahlentherapie*, 1951, *85*, 196) that the applied energy of ionization per gm. of tissue is less in P^{32} therapy than in roentgen irradiation of the total body.

At the Medical and Roentgen Departments of the University of Hamburg-Eppendorf 17 polycythemic patients, 12 men and 5 women, were treated with P^{32} since March, 1950. Ten of these cases were observed sufficiently long to be used for evaluation. All showed the full scale of symptoms and most of them were observed for years, so that there was a good chance for comparison with previous therapy. Dosage was varied according to age, general condition, blood status and preceding treatment. In general 0.06 mc. per kg. was given at the start,

followed after two to three months by further sometimes considerably higher amounts. Assuming a homogeneous distribution, daily doses of 2–4 rep/gm. on the first and about 0.5–1.0 rep/gm. on the thirtieth day were calculated, disregarding elimination which occurs to 80 per cent in the urine and 20 per cent in the stools. The theoretical integrated dose amounts to about 40–80 rep/gm., while the actual dose is about 35 per cent lower. Oral administration would be preferable for reasons of better protection from radiation; the intravenous route was chosen to avoid the 25 per cent loss in enteral absorption. One millicurie of the active substance was dissolved in 2 cc. of 0.9 per cent NaCl and 0.005 per cent Na_2HPO_4 solution. The drug was well tolerated without untoward effects. Subjective improvement was seen after three to four weeks, while the bluish-red coloring of the skin, the conjunctival injection, the enlarged liver and spleen, and the high erythrocyte count usually receded after three months, the maximum effect being reached after four to five months. The authors occasionally observed an initial rise in erythrocytes. The leukocytes were the first to drop in number, then the thrombocytes, reaching their lowest level at the sixteenth week, followed by the red cells. A table shows the hemoglobin, platelet, red and white cell values before and after use of P^{32}. In 2 patients anemia of 60 per cent, leukopenia of 2,000–3,000 and thrombopenia of 45,000 were observed with spontaneous recovery. At the time of the lowest blood count supravital marrow studies showed a quantitative insufficiency without qualitative changes and especially no karyokinetic disturbances.

Animal experiments failed to show a shift in the reticulocyte count as a result of the beta irradiation with P^{32}. The repeated withdrawals of blood probably masked the changes in the marrow activity; the latter was slowed demonstrably by making the rats anemic to about 40 per cent soon after administration of P^{32} or roentgen rays.

The authors draw the conclusion that in practical therapy the regenerative impulse of venesection would best be counteracted by simultaneous administration of P^{32}. In this way the increased metabolism of the bone marrow would also enhance its tendency to incorporate the radiophosphorus.—*H. F. Plaut, M.D.*

BRANSON, HERMAN, and BANKS, L. OTTO. The turnover time of phosphorus in normal, sickle cell trait, and sickle cell anemia blood *in vitro* as measured with P^{32}. *Science*, Jan. 25, 1952, *115*, 89–90.

Individual blood samples from 10 normal (average age 10.5 years), 9 trait (average age 23 years), and 7 sickle cell anemia patients (average age 9 years), were incubated under given conditions with radiophosphorus (P^{32}) for four hours at 38°C. In this paper only total phosphorus content is reported.

Mathematical considerations, on which the determination of the turnover time ("that interval during which the amount entering the cell equals the amount present") is based, are explained. In vitro, in sickle cell anemia, the turnover time of phosphorus is about 2.5 times longer than in normal cells. The authors also state that for all other phosphorus fractions examined, the following turnover time relationships exists: τ normal $< \tau$ trait $< \tau$ sickle cell, where τ would be the turnover time.

The exact mechanism for this striking alteration of phosphorus exchange is unknown. Differences in membrane permeability, or in surface/volume ratio, are not sufficient to explain this difference.—*Z. S. Gierlach, M.D.*

WISHAM, LAWRENCE H., and YALOW, ROSALYN S. Some factors affecting the clearance of Na^{24} from human muscle. *Am. Heart J.*, Jan., 1952, *43*, 67–76.

In an original report, Kety (*Am. Heart J.*, 1949, *38*, 321) theorized that the rate of clearance of injected radioactive sodium from tissue would be proportional to the amount, and therefore a plot of the activity above the injection site as a function of time would be a straight line. Other investigators ran similar experiments and found the clearance slope not to be a straight line if the clearance was followed for time periods of twenty to sixty minutes. The authors, in a previous report, confirmed the latter finding but indicated that it was not inconsistent with Kety's theoretical presentation.

Using techniques as previously (Wisham, L. H., Yalow, R. S., and Freund, A. J. *Am. Heart J.*, June, 1951, *41*, 810–818), they found that clearance slopes of injected Na^{24} from skin are straight lines when plotted as a function of time on semi-logarithmic paper. Clearance from subcutaneous tissue is slower but also yields a straight line plot. The muscle curve has two components, the second representing the clearance from subcutaneous tissue of radioactive sodium which was deposited as the needle was withdrawn from the muscle after injection. If the subcutaneous tissue component curve is point by point subtracted from the raw data muscle clearance curve, a true straight line muscle clearance curve results.—*Harold Fulton, M.D.*

CRAMER, H., BRILMAYER, C., and PABST, H. W. Tumordiagnostik durch selektive Speicherung von Radiophosphor, Natriumfluorescein und Atebrin. (Tumor diagnosis by selective storage of radiophosphorus, sodium fluorescein and atabrin.) *Schweiz. med. Wchnschr.*, Jan., 1952, *82*, 76–78.

The value of several tests for early diagnosis of malignant tumors is still rather controversial. The authors therefore, attempt, to make a new attack upon the problem by means of biochemical methods.

They seek solutions to the following questions: Which substances are present in a malignant tumor that can be detected with biophysical methods? Which substances are selectively stored in tumor tissues? By what methods can such substances be exactly determined? Since according to investigations by Euler and Hevesy sarcomas and carcinomas use more phosphoric and nucleic acids than normal tissue, the authors use radioactive phosphorus in animals and patients and compare the emission of beta rays from the suspected tumor tissue with that of normal tissue by means of Geiger-Müller counters; 250 microcuries of radiophosphorus is injected intravenously and counter measurements are made both on the skin surface and in body cavities. The latter are carried out by means of small Geiger counter tubes which are built into flexible stomach tubing. No specific number of cases examined by these methods nor any statistical evaluation of results are presented. Only 2 cases are illustrated graphically. In 1 case of skin carcinoma the activity at the tumor tissue was 122 per cent higher than that at an appropriate control area. In a second case of fibrosarcoma the count even after seven days over the tumor area was 91 per cent higher than that at the control area. In positive cases the authors require a minimum increase of 25 per cent over the control. Although results are encouraging, the method is difficult and the equipment expensive. Some of the statements made in regard to the method are vague and a reference to the Mutscheller tolerance dose seems to be somewhat obsolete.

Since only larger institutions are equipped with suitable measuring instruments for radioactive isotopes, the authors recommend simpler methods for tumor diagnosis. Sodium fluorescein is accumulated in tumor tissue and its presence can be detected with the aid of Wood's light (ultraviolet). It is normally excreted within fifty to seventy hours. Traces as small as 0.1 microgram per milliliter of urine can be detected by means of a Beckman spectrophotometer. After intravenous injection of 2 milliliters of a 20 per cent sodium fluorescein there is a definite peak at 490 millimicrons which normally remains for not more than seventy hours. In tumor cases, however, this peak reappears after a certain interval and may remain up to 2,000 hours after injection. This phenomenon was observed on patients with all kinds of neoplasms as well as with lymphogranulomatosis and leukemia.

Equally satisfactory but simpler is the spectrophotometric study of urine after intravenous injection of 0.1 gram of atabrin. In normal cases, peaks are observed at 420, 430 and 450 millimicrons which last up to forty hours. In tumor patients they can be observed only up to three hours.

These three methods have been tested on many animals and on almost 1,000 patients. Yet the authors feel that there remain still many unsolved problems which require further clarification.—*Otto Glasser, Ph.D.*

CHEMOTHERAPY

Lewison, Edward F., and Chambers, Robert G. The sex hormones in advanced breast cancer. *New England J. Med.*, Jan. 3, 1952, *246*, 1–8.

Eighty patients with inoperable, metastatic, or recurrent breast cancer proved by biopsy were studied during 97 periods of hormone administration. Criteria for steroid therapy were established by the Committee on Research of the Council on Pharmacy and Chemistry of the American Medical Association. All patients who either had had an artificial menopause or had received irradiation within the preceding six months were not accepted for this study. Androgen therapy was used in cases of bone or soft tissue lesions regardless of the patient's age. Estrogen therapy was used in postmenopausal cases. Postmenopausal state was considered as present in patients who had an artificial menopause six months or more before treatment or whose last menstrual period had occurred five years or more prior to treatment.

Subjective changes as evidenced by relief of pain, increase in appetite, weight gain, euphoria and increase in general feeling were reviewed by a panel of consultants and a favorable subjective response was found in 80 per cent of the patients receiving androgen therapy. A dose of 300 mg. per week was found to be most effective. This response occurred after an optimum period of about three months of treatment and after 2 gm. of testosterone.

A favorable subjective response occurred in 52 per cent of patients receiving estrogens. Prolonged treatment appeared to improve this response and to extend its duration, especially in older women.

Objective response was found difficult to gauge and regression of lesions was found to be transient and unpredictable. Improvement was indicated by decrease in size of skin nodules, healing of ulceration or favorable roentgenographic changes. In patients treated with testosterone, improvement of bone metastases occurred in 25 per cent of treated cases. Thirty-five per cent of soft tissue lesions improved under androgen therapy with no difference noted between the premenopausal and postmenopausal groups. Testosterone was found to have the least effect on primary tumors.

Twenty-seven per cent of patients treated with estrogens showed objective improvement in bone metastases. Soft tissue lesions improved in 32 per cent of the estrogen-treated cases. Lung lesions showed the least response and favorable soft tissue response increased with advancing age.

In concluding, the authors state that estrogens were found to be of the greatest value in advanced breast cancer of older postmenopausal women whereas androgens were of benefit regardless of age. They emphasize that steroid therapy is by no means a cure for advanced cancer but that used properly it

may alleviate suffering and lengthen life.—*R. W. Emerick, M.D.*

MICHEL, HERMANN. Kritische Bemerkungen und Beobachtungen zur Urethantherapie der chronischen Myelose in den letzten 5 Jahren. (Critical remarks and observations regarding urethane therapy of chronic myelosis in the last five years.) *München. med. Wchnschr.*, Jan. 18, 1952, *94*, 117–121.

At the Medical Department of the Nymphenburger Krankenhaus, Munich, 10 chronic myeloid leukemias, 2 chronic myeloid leukemias with terminal shower of myeloblasts, 1 acute micromyeloblastic leukemia and 7 chronic lymphatic leukemias were treated with urethane in the last five years. In addition the drug was given in several other conditions. In tumors, polycythemias and Hodgkin's disease either no or only a minor and transient influence on the course was observed by the author. He believes that in the future urethane will be used only in chronic myeloid leukemia. Multiple myeloma is not mentioned.

The therapeutic action of urethane is threefold, namely interfering with the mitosis, lowering the surface tension of the cell and affecting the animated virus of leukemia without direct effect on formation of the red and white cells and platelets. These cytostatic or cytotoxic actions can be brought under the general heading of cell narcosis. Other influences were observed in experiments with water and mineral exchange of animals by Epstein. The author found augmented diuresis during urethane medication in one patient. The increased production and elimination of uric acid as a result of cell disintegration disturbs the colloidal equilibrium and may lead to formation of stones in the gallbladder and urinary tract.

A case history is presented, showing fall of leukocytes from 95,000 to 15,000 after a dose of 8 gm. of urethane in five days with nearly complete reduction of the shift to the left. The drug was then immediately withheld. A nearly universal polyarthritis, acute febrile cholangitis and cholecystitis, microhematuria and pyuria developed in the course of a leukopenic phase.

A second case history relates good control of a chronic myeloid leukemia in a forty-five year old patient with 98 gm. of urethane in the fall of 1947, with reduction of the white cells from 94,000 to 5,000 and of the immature granulocytes from 54 per cent to 6 per cent and improvement of his general condition. In the first half of 1948 the leukocytes changed around a level of 20,000. In the fall of 1948 the count rose to 119,000. This and later relapses were treated by arsenic and urethane. After a period of treatment by a homeopathic physician the leukocytes rose to 356,000 with 56 per cent immature cells and 35 per cent segmented. Combined arsenic and roentgen therapy from December, 1950, to February, 1951, gave insufficient remission. In March, 1951, a dose of 8 gm. of urethane in four days and only one irradiation of the spleen were given; the white cells were reduced from 77,000 to 26,500. Further single roentgen treatments of the spleen for changing counts produced every time a good reduction in leukocytes, last observed in August, 1951, at 17,900.

Some authors consider pushed doses of urethane with long intervals to be dangerous and leading to allergic or anaphylactic reactions of the bone marrow with terminal myeloblastic shower. This also holds true for any combined administration of roentgen therapy and urethane in intervals. The author advocates uninterrupted treatment for a longer time with equal doses of urethane. It may be intensified in several ways and combined with other cytostatics or with supporting roentgen therapy, taking special care in observing the changes of the blood.—*H. F. Plaut, M.D.*

BRICK, IRVING B., and KYLE, LAURENCE H. Jaundice of hepatic origin during the course of methyl-testosterone therapy. *New England J. Med.*, Jan. 31, 1952, *246*, 176–179.

This is a report of 2 cases of jaundice developing during oral administration of methyl-testosterone.

(1) A forty-four year old man received 75 mg. of testosterone propionate weekly for three months, followed by 25 mg. weekly for five months and then took methyl-testosterone, 30 mg. daily, sublingually, for seven weeks prior to the onset of the present illness. He was discharged after six weeks. He resumed his activities and eight months after discharge there has been no return of the hepatic symptoms.

(2) A sixty-three year old man had received 25 mg. testosterone propionate, thrice a week hypodermically for eight months. Then for four months prior to the present illness, he was given methyl-testosterone, 30 to 40 mg. daily, sublingually.

Both cases had severe and prolonged jaundice. There was no fever or chills, and blood or plasma or any other injections had not been given in either case. A review of the literature by the authors revealed reports of 12 other cases of jaundice occurring during methyl-testosterone administration. The various authors point out that free testosterone and testosterone propionate have not been indicated but only the methyl product has been implicated.

In the cases quoted by the authors as well as in their own cases, the laboratory findings were characterized by negative cephalin-flocculation and thymol-turbidity tests, moderate elevation of the serum alkaline phosphatase and a reduced serum cholesterol-ester fraction. The serum albumin and globulin determinations were normal, as were the sedimentation rates, serologic tests for syphilis and complete blood counts.

In the second case, as well as in cases reported in the literature, there was no fatty infiltration of the liver. The histopathologic lesions found were stasis of bile with plugging of bile canaliculi in the central zones of the liver lobules and mild hepatic cell damage. There was no evidence of obstruction of the biliary system distal to the central zones.

The authors point out that the administration of methyl-testosterone should be regarded as a possible etiologic factor in cases of jaundice.—*R. K. Arbuckle, M.D.*

MISCELLANEOUS

Wedekind, Th., and Wetzels, E. Eine neue Methode zur Herstellung von Röntgenschichtaufnahmen. (A new method for roentgen laminagraphy.) *Schweiz. Ztschr. f. Tuberk.*, 1952, *9*, 129–135.

Laminagraphy is essential to a complete roentgen examination of the lungs in many instances. The standard apparatus, first devised by Bocage, achieves the purpose of layer roentgenography by a coordinated, contrariwise movement of the roentgen tube and the film cassette during the time of exposure. In this method the proportion of the distances between roentgen tube and object and between roentgen tube and film is the same during the entire exposure. The same proposition holds true when patient and film cassette move coordinately during the exposure, while the roentgen tube remains stable.

The construction of the new type of laminagraph was started by Wedekind and Kemper in 1949. It is called the homalograph. Some technical improvements have been added by the authors. Fundamentally, the homalograph is a chair connected to a cassette holder in a stand in such a way that both can move around a horizontal axis. The chair, which has been tipped backwards, is moved downward by its weight and that of the patient for an angle of 50 degrees during the 1.6 second exposure. The current is turned off and on automatically by electrical relays. The thickness of the body layer is regulated by moving the cassette holder forward or backward on an easily visible scale. Other technical considerations should be read in the original.

Simplification of construction, easy operation and sharp images seem to be the advantages with this type of laminagraph.—*Hans W. Hefke, M.D.*

Greenberg, I. Melbourne. A simple device for position determination during myelography. *J. Neurosurg.*, Jan., 1952, *9*, 108–110.

The author describes a device which enables the film viewer to appreciate the direction and table angulation existing at the time films are exposed during myelography.

The device consists of two parts. The one part is a linear glass tube, of the type used in a carpenter's level, half filled with pantopaque. The second component is placed in close apposition. This consists of a freely moving metallic ball sealed between two protractors having a radius of 1⅞ inches. The device is secured beneath the fluoroscopic screen with adhesive tape.

The device is obtainable from the manufacturers of roentgen apparatus or from the author.—*I. R. Berger, M.D.*

Wicke, G., and Marthen H. Über die Verträglichkeit von Joduron B im Tierversuch. (Tolerance of ioduron B as demonstrated by animal experiments.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Jan., 1952, *76*, 82–85.

Ioduron B has been used in bronchography and has proved to be a nonirritating, nonfatty medium that is speedily absorbed.

The authors injected 1 cc. of ioduron B with 1 cc. of air into the peritoneal cavity of guinea pigs in order to demonstrate the peritoneal cavity and to obtain some data about the tolerance of the peritoneum to this contrast material.

It was possible to visualize some of the abdominal organs covered by the ioduron, when roentgenograms were made almost immediately after intraperitoneal injection. After thirty minutes no detailed shadows were recognizable; after three to four hours all traces of the opaque medium had disappeared because of absorption and the bladder was shown to contain the excreted ioduron.

No animals died following the injection; the anatomical reaction of the peritoneum was only that of a mild foreign body reaction. Late injuries could not be demonstrated when the guinea pigs were killed twelve weeks later.—*Hans W. Hefke, M.D.*

Campi, L., and Abeatici, S. Modificazioni del circolo spleno-portale dopo legatura dei rami venosi lienali (ricerche flebografiche sperimentali). (Modifications of the spleno-portal circulation following ligation of the venous branches of the spleen; experimental phlebographic investigations.) *Radiol. med.*, Jan., 1952, *38*, 1–9.

After giving a brief review of the pertinent literature, the authors state that considerable controversy still exists as to whether enlargement of the spleen constitutes a sequel to stasis caused by partial or complete interruption of the venous circulation (thrombosis of the splenic vein) or is a primary manifestation of a pathologic process which affects the spleen and the splenic vein simultaneously. The problem is not easy to solve since many factors are implicated in the pathogenesis of the splenomegalic syndrome and since the results of animal experiments are not necessarily transferable to situations in the human being.

To throw some additional light on the subject the authors performed two series of experiments on dogs. They ligated in one series the principal trunk of the splenic vein and in the other all the hilar veins of the spleen. The occlusion was performed by applying a double ligature about 1 cm. apart. The dogs were operated upon under intraperitoneal chloral hydrate (10 per cent) and morphine anesthesia.

At intervals of 1, 5, 10, and 20 days following the venous occlusion phlebograms were made by injecting 5 cc. of 70 per cent ioduron through the abdominal wall into the parenchyma of the spleen. This procedure likewise was done under intraperitoneal chloral hydrate and morphine anesthesia. Three films were exposed successively at five second intervals, starting immediately after the completion of the injection, to gain some information about the rapidity of development of the collateral circulation and the degree of stasis still present. The results of these observations are described in detail and illustrated with reproductions of representative phlebograms.

In general, it was found that in both series of experiments the return circulation had been progressively re-established (somewhat more rapidly in the first than in the second series) through the indirect collateral veins and to a minimal extent through the direct collateral veins. No enlargement of the spleen followed the stasis in a single instance.—*T. Leucutia, M.D.*

Fritz-Niggli, Hedi. Quantitative und qualitative Analyse der Röntgenschädigung im Drosophila-Versuch. (Quantitative and qualitative analysis of roentgen-ray injury in the *Drosophila* experiment.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Feb., 1952, *76*, 218–254.

The author investigated the biological damage caused by roentgen rays upon the pupas of *Drosophila* flies and correlated the shape of damage curves with genetic-physiological observations. Pupas of *Drosophila melanogaster* lend themselves particularly well to these studies since they have tissues in histolysis, in morphologic and cytologic differentiation, at rest and embryonic blastemas.

Pupas of various ages, from five to seventy-two hours, were irradiated with roentgen rays of two qualities: 50 kv., 2 ma., 0.2 mm. Al filter, 14 mm. focal distance; and 180 kv., 6 ma., 2 mm. Al filter, 20 cm. focal distance. Radiation dosages were 6,000, 12,000, 36,000 and 80,000 roentgens.

Results demonstrated that the resistance of the pupas to irradiation increases considerably with increasing age. This increase is especially noticeable in the age range of thirty to thirty-five hours. Irradiation with dosages up to 36,000 r does not kill the pupas and most of them reach the hatching age. Doses of 80,000 r always interfere with further development and frequently stop it entirely. Pupas which are irradiated at the age of from one to forty hours and which die at the hatching age show interrupted growth of the body wall. The extent of this defect depends upon age and radiation dosage; it comprises changes in the bristle design of the head, thorax and abdomen as well as a lack of development of the hypodermis, muscles, cenocytes and fat cells. The injury consists of absence of the special derivatives of the imaginal integument histoblasts, since the imaginal cuticle is retarded or absent; similarly, the muscles, notably the dorsoventral muscles, may disappear. Damage is related to the genetic-physiological state of the irradiated tissues and the death of young irradiated pupas is due to the defect of the integument. Unknown remains, however, the cause of the death of the fifty hour and seventy-two hour old pupas which were given large dosages. It is probably due to general injuries.

The biological effect increases only slightly with increasing dosages and a certain saturation status is reached after a threshold value has been passed. The shape of the gonads is changed by irradiation but no effect upon the germ cells can be observed. The biological effects produced by the roentgen rays are similar to those caused by ultrasonic waves, by ultraviolet light and to a lesser degree by temperature shock. Roentgen rays seem to injure selectively those cells which have the highest gene activity. The differentiation of single organs which originate in the imaginal disks is not affected by the roentgen rays with dosages up to 36,000 r. Mitotic activity is not noticeably disturbed.

The roentgen rays probably act upon the active gene itself or act at an early stage of the differentiation process.—*Otto Glasser, Ph.D.*

Chantraine, H. Erbschädigung durch Röntgenstrahlen? (Hereditary damage through roentgen rays?) *Röntgen-Blätter*, Jan., 1952, *5*, 1–10.

In a rather speculative article the author, a world authority on radiation effect, presents his arguments for rational consideration of the radiation danger problem.

At the 1930 Berlin Congress for the first time in Germany the hypothesis of hereditary damage by roentgen rays was announced. It stated that in differentiation from other noxious agents, roentgen rays not only damage the person using them, but also may adversely affect his germ plasm and thus indirectly damage members of future generations.

Since the presentation of this startling thesis, at that time and as yet unproved in man, the arguments of the roentgenophobes have become so strong that many believe that the truth or fallacy of this belief must be tested on man directly. By good biological and medical knowledge combined with sound logic one can ascertain whether experi-

mental results on animals, particularly *Drosophila*, can be transferred to man. In mouse experiments the results can be studied at the end of 40 to 50 generations; for man the effect will perhaps be evident by the year 3200.

In *Drosophila* there are spontaneous mutations in addition to the roentgen-induced mutations. Roentgen irradiation increases the number of mutations in proportion to the amount of exposure. This holds also for man, *i.e.*, roentgen-ray exposure increases the number of otherwise arising mutations. In the past 150 years technical and hygienic developments have allowed men with poor germ plasm to live and propagate. It is unfair, therefore, to say that roentgen rays have for the first time brought the human germ plasm in danger. In the author's opinion, "the degeneration of germ plasm through roentgen rays is a slight and remote possibility." The use of roentgen rays is not dangerous and the number of mutations will not be artifically increased as long as the number of roentgen mutations remains as small as compared to the number of spontaneous mutations arising through cosmic rays and radioactivity of the earth's surface. In this case man has a safety factor of 100 in that only a small portion of the spontaneous mutations arise through influence of cosmic rays and natural radioactivity, inhabitants of earth being exposed to only about 0.75 r per year from these sources.—*Harold Fulton, M.D.*

Rosahn, Paul D., Tobias, Cornelius A., and Lawrence, John H. Effects on the white mouse of a single whole-body exposure to 190 mev. deuterons. *Am. J. Path.*, Jan.-Feb., 1952, *28*, 37–50.

This preliminary study is based on 100 white mice of the Strong A strain. Twenty were used to establish a blood study base line. Three groups received deuteron bombardment: I, 13 mice, 3.8×10^4 ergs/gm.; II, 12 mice, double the initial dose; III, 15 mice, quadruple the first dose. Each group had equal number of controls.

Results reported are similar to those known to occur following roentgen or neutron irradiation. Group III had no survivors after the fourth day, and had the heaviest early weight losses. In group I the last survivor was sacrificed for study on the twenty-third day. All groups maintained red blood cells at control values except for a transient slight early rise. Total white blood cell, absolute lymphocyte and neutrophile counts dropped to low levels within twenty-four hours.

Bone marrow had generalized depression. Group I had maximum aplasia on the fifth day, followed by regeneration, and (18th day) hyperplasia. Twenty-four hours after irradiation all lymph nodes showed damage. Processes of restitution were noted on the third and fifth days. Splenic tissue recovered slower. —*Z. S. Gierlach, M.D.*

Furth, F. W., Coulter, M. P., and Howland, J. W. The effect of aureomycin on the radiation syndrome in dogs. *Am. J. Path.*, Jan.-Feb., 1952, *28*, 25–36.

From the literature it is known that a significant part in the postirradiation syndrome is played by a hemorrhagic diathesis. This is followed by a panhematopenia and a decreased antibody response to bacterial antigens in the state of sepsis.

Twenty-four adult healthy mongrels received 400 r total body irradiation of 250 kv. roentgen rays with 0.5 Cu filtration. Of this group, 12 received about 25 mg. aureomycin per kg. per six hours for twenty-eight days.

In the treated animals, there was a delay in onset of the usual postirradiation symptoms of weakness, lethargy and anorexia. A finding of significance was the definite delay in onset of death in the treated group. The first control dog died on the tenth, while the first treated animal died on the seventeenth post-irradiation day. Gastrointestinal and other hemorrhages occurred more frequently in the control group, and therefore their red blood cell levels were lower. Platelets and white blood cells responded similarly in both groups. Feces analyses showed higher levels of coliform organisms in treated animals.

Various causes for the observed delay in onset of morbidity and mortality in the aureomycin-treated group are discussed, and it is suggested that an actual antitoxic effect of aureomycin may exist; this in addition to the bactericidal effect.—*Z. S. Gierlach, M.D.*

Fossati, Franco, and Terra, Luigi. Il dosimetro radiologico integratore vincitore del concorso S.I.R.M. (Integrating radiologic dosimeter, prize winner of the S.I.R.M.) *Radiol. med.*, Jan., 1952, *38*, 26–33.

This article gives a detailed description of the principle, construction, and the various types of ionization chambers of the Fossati-Terra integrating dosimeter which won the national prize of the Società Italiana di Radiologia Medica.

The following are the essential features of the instrument: measuring circuit making use of an electrometric tube which acts as a relay; direct expression of the dose in r by means of an electrometric device; automatic interruption of the high voltage circuit; complete stability; thimble and flattened ionization chambers for measuring the dose in contact therapy, superficial and deep roentgen therapy (of 30 kv. to 250 kv. range), and, under specified conditions, in gamma therapy.

The accompanying illustrations include photographs of the instrument and of the various types of ionization chambers and a diagram of the electrical system.—*T. Leucutia, M.D.*

BOMKE, HANS. Das neue Radium-Momentan-Dosimeter nebst prinzipiellen Erörterungen zur Radiumdosimetrie. (A new instantaneous radium dosimeter and the principles of radium dosimetry.) *Strahlentherapie*, 1952, *86*, 345–352.

The radium dosimeter under discussion is constructed to permit dosage measurements within a few seconds, hence it is described as instantaneous. It is built to measure radiation intensities from 1 gamma roentgen per hour to 300 gamma roentgens per hour. Several ionization chambers are interchangeable. The smallest is 6 mm. in diameter and tiny enough to be inserted into the urinary bladder via the urethra without incommoding the patient. The connection between the chamber and the measuring instrument is a flexible cable.

This new radium dosimeter has proved practical, particularly in gynecologic therapy.—*Henry G. Moehring, M.D.*

WOLLUM, ARNOLD, GLASER, DANIEL F., BRYANT, HENRY C., and POLLARD, H. MARVIN. Cytologic study of the gastric aspirate for carcinoma cells; paraffin-block technic. *J. Nat. Cancer Inst.*, Feb., 1952, *12*, 715–721.

The authors have used the paraffin-block technique to study cells from the gastric aspirate. They compared this method with the standard Papanicolaou technique.

In the paraffin-block method the gastric contents are aspirated following an overnight fast. Then the stomach is lavaged with 50 cc. of saline or Ringer's solution. The specimens are fixed in an equal amount of formaldehyde and imbedded for tissue study. Sections are examined microscopically for carcinoma cells.

From the pathologist's viewpoint, the advantages are: the material is concentrated and the time required for study is less. There is a clearer definition of the cells and the cellular relationships are preserved.

Examination by this technique yielded a positive result of 20 per cent in 43 cases with histopathologically proved gastric cancer and 1.1 per cent false positive in 474 cases with gastric cancer. This is compared with the range in positive by the routine Papanicolaou method of from 23.8 per cent to 73.9 per cent reported in the literature. On the other hand, the routine Papanicolaou technique yields an average false positive range of from 2.5 to 7.0 per cent.

In analyzing the relatively poor showing of the paraffin block technique, the authors cite the smaller amount of cellular material examined in a limited number of sections through a small block as one cause. Another cause is gastric retention of any degree.—*Israel R. Berger, M.D.*

HORNYKIEWYTSCH, THEOPHIL. Physikalisch-chemische und histochemische Untersuchungen über die Wirkung der Röntgenstrahlen. (Physicochemical and histochemical investigations of the effect of roentgen rays.) *Strahlentherapie*, 1952, *86*, 175–206.

Numerous animal experiments demonstrated that, besides local physical ionization effects, the entire organism reacts to irradiation. This general reaction is presumably due to the formation of strongly oxidizing substances from irradiated water and tissue fluids.

Total body irradiation with 800–1,000 r produces Selye's general adaptation syndrome. However, *antecedent* administration of 500–600 mg./kg. of cysteine prevents the development of this syndrome. It seems likely that the -SH groups of cysteine neutralize the effect of the oxidizing substances produced by irradiation, and thus prevent those substances from evoking the general reaction. During this process, the cysteine is altered to the biologically inactive cysteine.—*Henry G. Moehring, M.D.*

NAHON, JOSEPH R., and NAIDORF, CARROL P. Comparative study of x-ray transmission in thorax and abdomen in living subjects. *Radiology*, Feb., 1952, *58*, 241–245.

Extreme damage and death following tumor doses of 5,000 to 9,000 r to the lungs suggested that isodose curves based on presdwood phantoms did not apply to the lungs. Work with a fresh calf's thorax indicated that a plywood phantom of density 0.5 more closely approached the absorption rate of lung tissue. For further confirmation, exit doses from radiation through the right chest and left lower abdomen were measured on 100 normal patients. A scatter diagram showed that the mean exit dose over the thorax was much greater than that over the abdomen. In addition, for the same tissue thickness, differences in exit doses up to 100 per cent over the abdomen and 250 per cent over the thorax were noted. These results suggest that depth dose calculations should be individualized.—*Martin B. Goodwin, M.D.*

KELSALL, MARGARET A., and CRABB, EDWARD D. Increased mast cells in the thymus of x-irradiated hamsters. *Science*, Feb. 1, 1952, *115*, 123–124.

Thirty-four hamsters were individually subjected to one exposure of roentgen rays. Four other groups were used to determine the effect that thymic involution produced by other means has upon the number of mast cells.

A significant increase of mast cells occurred in all 20 of the 34 irradiated hamsters which had thymi in the inversion (shift of lymphocytes from cortex to medulla) stage of involution. Thymi of 10 of the 34 irradiated hamsters in the extreme depletion stage

were as small or smaller than those in the inversion stage; they had fewer lymphocytes and more condensed stroma, but no increase in the number of mast cells like those thymi in the inversion stage.

Macroscopic gastroenteric hemorrhage occurred in 11 of 20 hamsters in the inversion stage of thymic depletion and in 6 of 10 hamsters with extreme depletion of the thymus. Since mast cells are considered to be a source of heparin, their increase during involution may augment the effects of the thrombocytopenia that occurred in all the irradiated hamsters.—*John D. Reeves, M.D.*

von Essen, Carl F., and Kaplan, Henry S. Further studies on metastasis of a transplantable mouse mammary carcinoma after roentgen irradiation. *J. Nat. Cancer Inst.*, Feb., 1952, *12*, 883–892.

One of the authors in a previous paper demonstrated a significant increase in the rate of pulmonary metastases following local irradiation of the Bagg-Jackson mouse mammary carcinoma 755.

The present paper presents the results of five subsequent experiments.

Experiment 1. After the tumor tissue implanted into the thigh reached a diameter of 1 cm. the mice were divided into three groups. In one group, the tumor was irradiated, in another the opposite (normal) thigh was irradiated and the third group served as control. In the tumor irradiated group there was an incidence of 45 per cent of pulmonary metastases while in the other group the incidence was 10 per cent. The control group had an incidence of 15 per cent pulmonary metastases.

Experiment 2. This experiment was performed to determine whether the effect of irradiation in enhancing metastatic frequency partakes of the nature of a "somatic mutation."

Mice implanted similarly to those in experiment 1 after development of pulmonary metastases were used. The metastases-bearing lungs were cut into small pieces and reimplanted into new mice. There were no pulmonary metastases in these mice.

Experiment 3. Local irradiation of the host alone prior to implantation, or of the tumor either in situ in a "previous" host, or in vitro failed to produce a significant rise in the incidence of pulmonary metastases.

Experiment 4. Tumors freshly excised from several mice were pooled in large test tubes, covered with a layer of paraffin and set in the refrigerator for approximately three months. The semiliquid material which collected was injected. This "XYZ" anaerobic autolysate failed to reproduce the effect of local irradiation on metastatic frequency of the tumor.

Experiment 5. Non-irradiated tumor cells in suspension were injected intravenously. This led to the development of pulmonary tumor nodules more often than in uninjected animals bearing a non-irradiated subcutaneous tumor.

The authors conclude that the effect of irradiation on metastases of this tumor involves a transient local disturbance of host-tumor relationship, probably concerned with facilitating entry of tumor cells into blood vessels.—*Israel R. Berger, M.D.*

Hollcroft, Joanne Weikel, Lorenz, Egon, and Matthews, Marion. Factors modifying the effect of x-irradiation on regression of a transplanted lymphosarcoma. *J. Nat. Cancer Inst.*, Feb., 1952, *12*, 751–763.

The authors, having previously reported on the regression of a transplanted mouse lymphosarcoma caused by the synergistic action of simultaneous body and tumor roentgen irradiation, now report the effects of different factors modifying the irradiation effects on the tumor.

It was shown by experiments on mice that a synergistic effect on regression of a transplanted lymphosarcoma occurred after simultaneous systemic and local tumor irradiation and was absent when the blood supply of the tumor was clamped off during systemic irradiation. The synergistic effect disappeared rapidly when the time interval between systemic and local tumor irradiation was increased from 0 minutes to 4 hours.

Starving the animals for 20 hours before and during local irradiation of the tumor was found to increase tumor regression, while starvation following irradiation had no effect.

Hydrogen peroxide given intravenously immediately before tumor irradiation increased the effect on tumor regression in comparison to noninjected irradiated controls but H_2O_2 after irradiation did not; likewise, when given 5 minutes before irradiation, it did not.

A high oxygen atmosphere produced a greater regression and irradiation of the tumors of mice in a low oxygen atmosphere produced less regression than of the tumor of mice breathing air.

Clamping off blood supply to the tumor during local irradiation of the tumor had no effect on tumor regression.—*Thomas S. Long, M.D.*

Kaplan, Henry S., and Brown, Mary B. Mortality of mice after total-body irradiation as influenced by alternations in total dose, fractionation, and periodicity of treatment. *J. Nat. Cancer Inst.*, Feb., 1952, *12*, 765–775.

The data reported herein are the by-product of an experimental study of the effect of alternations in total dose, fractionation, and periodicity of irradiation on the the development of lymphoid tumors in mice.

The lethality of total body roentgen irradiation

was studied in 1,753 strain C57 black mice of both sexes. The animals which were one month old at the start of treatment were randomized by litters into 35 groups, that recieved a graded sequence of total doses in single exposures or 2, 4, or 8 equal fractions at intervals of 1, 4, 6, 8, or 16 days. There was no sex difference in mortality. Analysis of the data by probit method yielded regression lines with LD-50 values of 486 r ±18 for single exposures increasing to 542 r ±22, 678 r ±71, and 850 r ±80 for 2, 4, or 8 daily fractionated exposures, respectively. A pronounced decrease in lethal effect was noted when the interval between fractionated exposures was increased to 4, 8, or 16 days, but the data did not permit accurate estimation of the LD-50 levels under these conditions.

A mathematical model is presented that fits the present data for daily fractionation and provides a tentative framework for additional dose response experiments.

For the data of this investigation the estimate of the true relation of this form is:

$$LD_{50}^{(n)} = 484.2(f)^{0.2115}$$

denoting that $LD_{50}^{(n)}$ increases roughly as the 5th root of the degree of fractionation over the range of fractionation used in this study. Whether or not LD-25 or LD-75 would fit the model is not known.—*Thomas S. Long, M.D.*

MAYNEORD, W. V. Some problems of radiation protection. The Silvanus Thompson memorial Lecture. *Brit. J. Radiol.*, Oct., 1951, *24*, 525–537.

The author lauds the many accomplishments and outstanding abilities of Silvanus Thompson.

The problem of protection against ionizing radiations is then discussed because of the numerous additional hazards of exposure and contamination which have appeared with the advent of their widespread use. These problems concern individuals in their actual application and large population groups by their being discharged into public water supplies. Since larger segments of our populations may be exposed to these radiations, irreversible, and for the most part recessive, genetic effects become of equal concern with the well known effects on hematopoietic structures and the production of radiation induced malignancies. The incidence of genetic effects would be slight, however, since two persons affected in this manner would have to mate in order that the injury would become evident.

In the author's department a large scale protection service was instituted to determine the magnitude of personnel exposure. Condenser ionization chambers were found to be less advantageous than film as a monitoring device due to their greater mechanical fragility, tendency to leak, and expense, despite their higher degree of accuracy. Films are sufficiently sensitive to detect exposures of 50 milliroentgens to 10 roentgens, even in the high energy region, with proper film selection. They can be used universally without the aid of a physicist and are more impressive to the wearer than the less comprehensible indicator of ionization measurement provided by the condenser chamber. Furthermore, permanent film records are valuable from a legal standpoint. Industrial roentgenographic film is used and the personnel badges are compared with films exposed to a known amount of radiation employing the comparative densitometer. Two films are carried by each person, one in the breast pocket position, and the other near the skin of the groin and abdomen. The latter shows about three-fourths of the dose registered on the breast pocket film in most instances.

It is desirable to estimate the quality of radiation as well as determining the quantity. Film holders having a thin tin back and a brass filter 1.5 mm. thick with a center hole of 10 mm. diameter were utilized for this purpose. Cadmium filters have also been employed to provide some degree of energy independence. Exposure from gamma rays and beta particles are comparative to some extent. Therefore the degree of film blackening has more meaning if the situation in which they were exposed is known.

Routine blood counts at three month intervals are done, preferably by the same technician, on all members of the staff. Originally only the physics department personnel were monitored, but this has been extended to include the entire hospital with particular attention to those handling radioactive isotopes, radium, and patients being treated with these agents. One of the most important aspects of the program involves educating the staff to the presence and danger of radiation, thereby obtaining their interest and cooperation. This "has been an embarrassing success" producing an increased load on the facilities of the pathology and physics departments.

The level of dose in the author's subjects was approximately the same as the officially established maximum permissible dose. When this maximum value was lowered, the individual dosage dropped, indicating that more stringent controls tend to make personnel more conscientious. It also appears that recuperative hematologic phenomena may not be evident for some years following a period of radiation contact, despite the absence of continued exposure.

The author points out that high voltage sources, adequately protected, may be less of a hazard than low voltage apparatus. The controls to high voltage equipment are usually placed at some distance and greater care is exercised in the erection of protective barriers. In dealing with low voltage generators, the worker is inclined to be less careful.

Radiographers in diagnostic work received little

radiation whereas those working with isotopes received near maximum amounts. Radium personnel received the highest exposures and due to the entrenched character of radium techniques, these situations present the most vexing problems. In general, the exposures measured were of the order of 60 to 70 milliroentgens per week which is well below the official maximum dosage rate of 300 milliroentgens per week. It has been demonstrated by others and substantiated by the author that levels of 50–125 milliroentgens per week produce a small drop in the total white blood cell count, the statistical significance of which is questionable. Levels of greater than 125 milliroentgens per week produce perceptible drops in total white counts, however.

On the basis of these figures, the question arises as to whether present maximum permissible dosage levels are excessive. The worth of such a monotoring program is unquestionable despite its expense. This is demonstrated by a reduction of the average dose to all workers to one-half the original values in a twelve month period.

Numerous graphs illustrate the text.—*Kenneth L. Krabbenhoft, M.D.*

Nightingale, A. The use of lead shot for protection from gamma radiation. *Brit. J. Radiol.*, Oct., 1951, *24*, 568–571.

The use of interlocking lead bricks of adequate thickness for protection from gamma rays is frequently cumbersome, and accessibility to instrumental controls is often impossible without sacrificing some degree of safety. Manipulation of these bricks is also hazardous to the maintenance of finely adjusted instruments. "Cavity walls" filled with lead shot are more easily fitted to such apparatus to give desired protection, permit easy manipulation, and maintain the integrity of delicate mechanisms.

The cavity walls are constructed of 1/32 inch galvanized iron, with necessary bracings at the corners for stability. The width is determined by the strength of the source being used. The cavity walls are easily filled with lead shot from the top and emptied through suitably placed openings near the bottom.

Lead shot of 0.1 inch diameter were studied to determine the alterations in emergent intensity from a screen of these shot due to the arrangement of closest packing of uniform spheres. Various geometrical arrangements of spheres result in "holes" through the assembly depending upon the distribution obtained, the size of the irradiation source, the size of the lead shot, and the uniformity of shot size. Radiographs of the emergent radiation obtained through 1 inch and 3 inch screens were made using five 5 mg. radium needles placed "end-on" with a diameter of 0.2 inch and placed "broadside" giving an effective area of 0.6 by 0.2 inch at a distance of 12 inches from the screen. Such a radiograph is reproduced.

Densitometer measurements, with a light beam of 0.04 inch diameter, were made of the mottled films where both screens had been used. These show that the local variation in film darkness compared with the absorption of gamma rays obtained through a solid lead step-wedge of 0.3 inch thickness corresponds to a variation of lead shot screen transmitted intensity of 15 per cent above and below the mean.

These experiments also indicate that true close-packing of the shot does not occur and the shot, in effect, forms clusters at the site of contact with the cavity wall. This is attested by the degree of uniformity in the radiographic pattern. There is no practical dependence on the source size or its distance from the screen. The radiograph is essentially produced by primary radiation since moving the film away from the screen results in virtually the same pattern of emergent radiation, and therefore discounts the possibility of exposure by scattered radiation.

It was also found that in filling and refilling the cavity, the percentage transmission was not materially altered and "shaking down" is therefore unnecessary. The theoretical ratio of equivalent lead shot thickness to specified lead solid thickness is 1.35, based on the closest packing of uniform spheres in cubic or hexagonal geometric patterns. In the range of 1.0 to 2.5 inch thickness, the experimental ratio, as measured with a 1 inch aperture Geiger-Müller counter, is 1.40 ± 0.3 which again attests to the failure of attaining close packing. With screens 0.5 inch in thickness this ratio is higher due to the slower initial drop of the graph of log intensity for lead shot than for solid lead due to variance in absorption of the softer components of the gamma-ray spectrum by the two media.

For thicknesses of lead of 1 inch or more, small lead shot may be used in lieu of solid lead in greater thicknesses by a factor of 1.4 This type of barrier is unsuitable for fixed object protection, such as for photographic material, since the porosity of the screen does not provide uniform protection. With moving personnel, however, no area is exposed excessively.

The advantages of lead shot cavity walls are that they have no cracks, and that they are easily adaptable to apparatus of irregular shape. They should not be used in thicknesses of less than 1.4 inches and the shot diameter should be less than that of the effective source diameter. Their initial cost is slightly higher but it obviates the necessity of making solid bricks of varying size. The attendant disadvantages of their use are enumerated.—*Kenneth L. Krabbenhoft, M.D.*

Archer, Vincent W., Cooper, George, Jr., Kroll, J. G., and Cunningham, D. A. Protection against x-ray and beta radiation; lead glass fabric. *J.A.M.A.*, Jan. 12, 1952, *148*, 106–108.

The authors, in considering the problem of the increased incidence of leukemia in physicians ex-

posed to radiation, feel that the exposure of parts of the body not covered by conventional protective devices might be responsible for this increased frequency. The arms, above the gloves, the shoulders, and the upper portion of the body are often exposed with the present methods of protection and, unless a lead-backed chair is used, the lower legs are exposed.

With the above ideas in mind they began to seek a flexible, crack resistant and cleanable protective material which might be used to improve present methods of protection. The idea of spun lead glass woven into fabric was conceived and a quantity of lead glass fabric was obtained. Transmission studies on varying thicknesses of this material showed that one thickness of lead glass fabric is equivalent in protection to 0.035 mm. of sheet lead. It was next determined how much protection was needed over the various parts of the body. This was done under actual working conditions by placing large intraoral dental films over eight different parts of the body during 43 fluoroscopic examinations. The density readings were made on an Owens-Sweet densitometer and these were double checked by a thin-walled stray radiation chamber. It is interesting to note that the voltage equivalent of the stray radiation, contrary to general belief, was almost the same as the primary radiation received by the patient.

After the amounts of radiation exposing the various parts of the operator's body had been noted, a gown was constructed using multiple layers of lead glass fabric in the areas which required the greatest protection. The experimental gown had the following thicknesses: abdomen, 5 layers; chest, 3; lower skirt, 2; shoulders to elbows, 2; lower arms, 3 and back, open. This gown, though somewhat lighter than the conventional lead apron, provided adequate protection to all parts of the body. It is emphasized that the amount of protection required varies greatly with the working conditions.

The advantages of the gown are as follows: (1) complete protection to all exposed portions of the body; (2) flexibility; (3) durability, the material withstands 22,000 flexes without evidence of breakage; and (4) cleanability, since the garment may be washed in soap and water. This material also provides efficient protection against beta radiation and may be used for shielding fields in superficial roentgen therapy since if folds as easily as a towel.—*D. L. Rousseau, M.D.*

Wachsmann, F., Breuer, K., and Buchheim, E. Grundlagen und Ergebnisse der Hartstrahltechnik. (Foundations and results of high voltage technique.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Feb., 1952, *76*, 147–157.

The tendency to increase tube voltage in diagnostic roentgenology is old. Twenty-five years ago, several authors published papers on high voltage technique using up to 100 kv. Recently, workers in Europe and the United States have employed voltages up to 125 and 130 kv. The following are the reasons for resorting to such a technique:

1. The harder radiation is less easily absorbed in the body than the soft one.

2. A greater amount of roentgen rays reaches the film.

3. A lesser exposure is delivered to the skin of the patient since greater filtration can be used. The ratio of entrance dose to exit dose diminishes with increased tube voltage.

Previously, it has been thought that the higher voltage would produce roentgenograms of less contrast. It has been shown, however, that with high voltages only bone structures appear less dense; lung detail is not diminished.

The authors describe two phantoms, one made of aluminum and the other of water equivalent plastic, which they used to prove the forementioned assertions.

Comparison of chest roentgenograms reveals that films exposed with 60 kv. and 20 ma. are comparable to those made with 150 kv. and 2 ma. At the same time, the dose to the patient decreases from 80 mr to 25 mr. Stomach films (with barium) allow a decrease of the milliamperage from 50 to about 5, with a resulting decrease of the dose to the patient from 2 r to 165 mr. Skull roentgenograms permit a decrease of the dosage from 2.2 r to 0.65 r but are not quite as good in quality as the roentgenograms made with the conventional kilovoltage.

The authors reach the conclusion that it is quite feasible to increase the range of diagnostic kilovoltage from 100 to 150. Stress to the tube and dosage to the patient's skin are diminished and roentgenograms are at least comparable but sometimes superior to the ones made with routine exposures.—*Egon G. Wissing, M.D.*